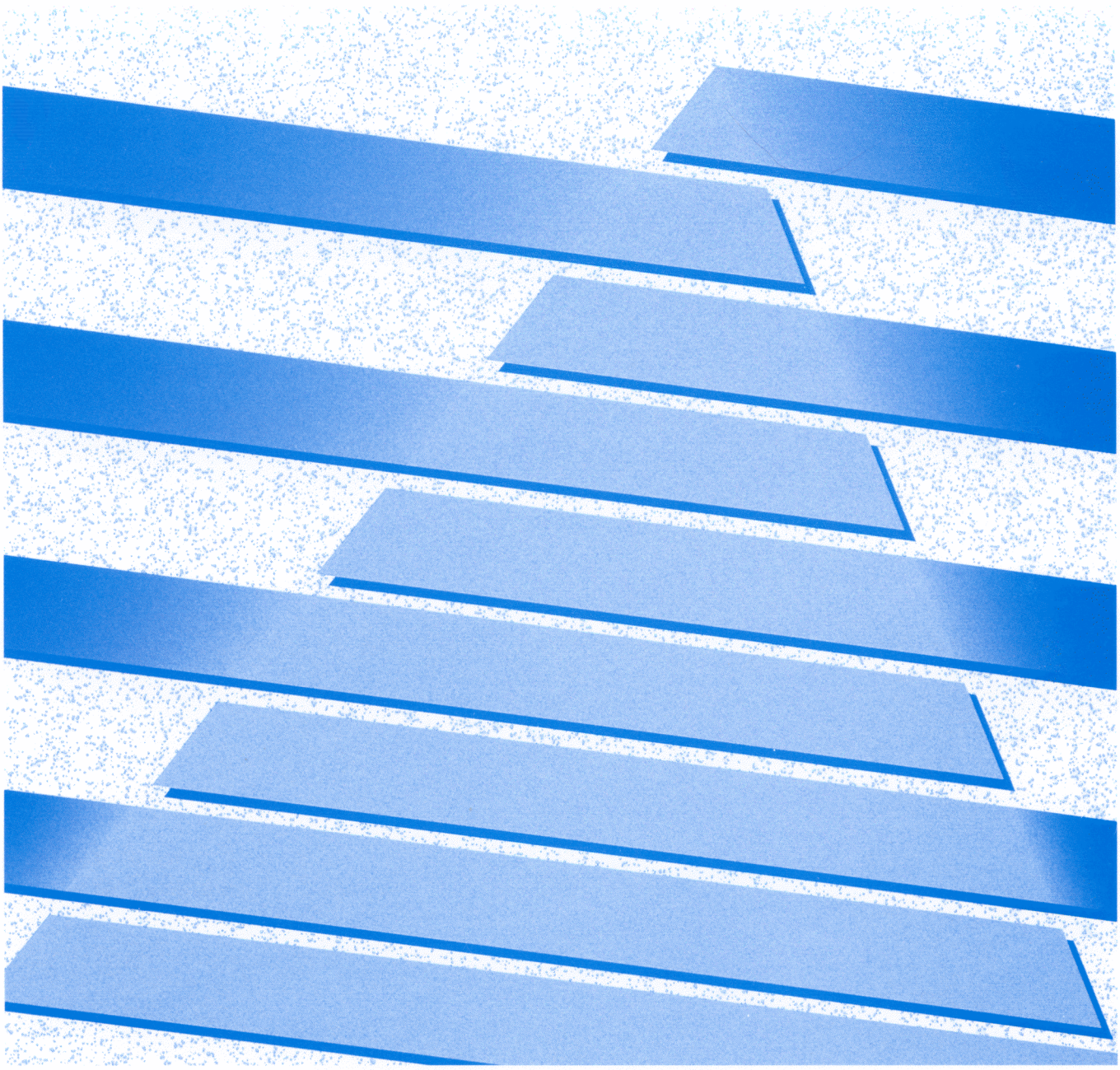
ALLEN-BRADLEY

Bulletin 5370
CVIM™
OCR-PAK™ Option

(Catalog Number 5370-OCR)

User Manual



Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. "Application Considerations for Solid-State Controls" (Publication SGI-1.1) describes some important differences between solid-state equipment and hard wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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Chapter 1 Using This Manual

Chapter Objective

The objective of this chapter is to provide an overview of the contents and organization of this manual. This chapter also defines the OCR-PAK™ option, describes the intended audience, lists related publications, and describes cautions.

OCR-PAK Option: Definition

The OCR-PAK option (Allen-Bradley Cat. No. 5370-OCR) is an enhancement to the Allen-Bradley CVIM™ module (Cat. No. 5370-CVIM) inspection windows, which provides a new capability – optical character recognition (OCR).

The OCR-PAK option is installed in the CVIM through the use of a memory card. With OCR-PAK installed, *OCR* is listed as an additional selectable option for CVIM module inspection window operation. All of the parameters for this new window operation are configurable through the CVIM module's popup menu environment, through the use of the light pen and monitor interface.

Manual Objective and Contents

The objective of this manual is to provide the procedures to both install OCR-PAK in the CVIM module, and configure the CVIM module in order to use the CVIM module for optical character recognition (OCR).

Chapter 2, *Application Considerations and Requirements*, describes key features, specifications, and restrictions in using the OCR-PAK option.

Chapter 3, *Installing the OCR-PAK Option*, shows you how to install the OCR-PAK option on the CVIM module.

Chapter 4, *Configuring OCR Windows*, describes the use of menus and other displays in configuring a window for OCR.

Chapter 5, *OCR Adjustment Features*, describes the use of special adjustment features for OCR windows.

Chapter 6, *Runtime Displays*, describes the use of the *Tool Display*, the *Results Page*, and the *Stat1 Page*, specifically regarding the OCR-PAK option.

Chapter 7, *Communications*, provides information which, in addition to the *CVIM Communications Manual*, is necessary to access OCR results and statistics data, and perform OCR-specific configuration functions using communications ports.

Intended Audience

Before using this manual, you should be familiar with the CVIM module and its configuration procedures.

For information, refer to the CVIM *User's Manual*, Cat. No. 5370-ND001 (Series B). In particular, review Chapters 8, *Inspection Tools: Windows*, and 10, *Runtime Functions*.

If you plan to use the CVIM communications port on the chassis backplane and/or front panel, refer also to the *CVIM Communications Manual*, Cat. No. 5370-ND002 (Series C).

Cautions

Notices of caution are used when the CVIM module or peripheral equipment could be damaged if the listed procedure is not followed. The following format is used:

CAUTION: This is an example of the format used for a caution.

Related Publications

The following manuals are cited for reference in this manual:

- User's Manual, Bulletin 5370-CVIM, Cat. No. 5370-ND001 (Series B) – also referred to as the *CVIM User's Manual* in this publication.
- Communications Manual, Bulletin 5370-CVIM, Cat. No. 5370-ND002 (Series C) – also referred to as the *CVIM Communications Manual* in this publication.

Chapter 2 Application Considerations and Requirements

Chapter Objective

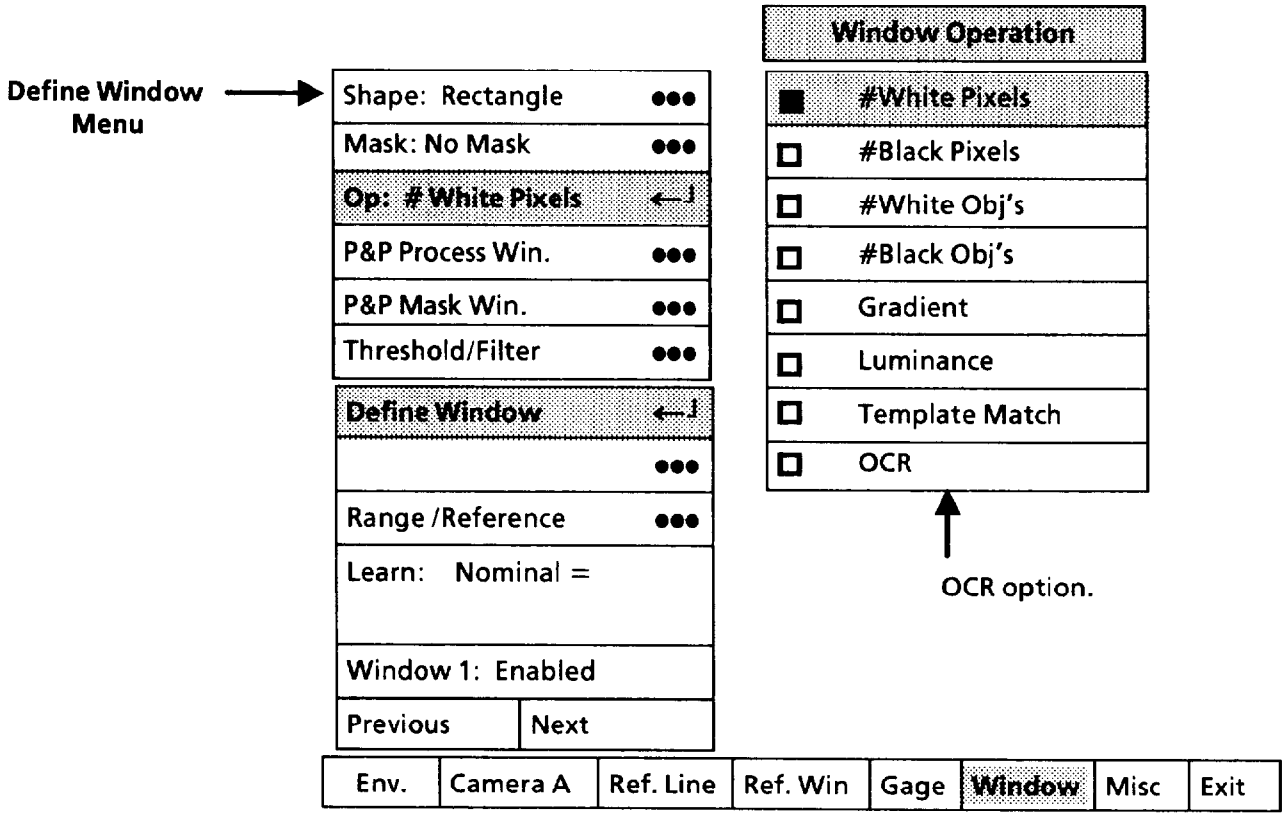
The objective of this chapter is to provide information regarding the capabilities of OCR windows, and the restrictions and requirements regarding the use of OCR windows.

Note: Read this chapter before attempting to use OCR-PAK.

Introduction to the OCR-PAK Option

The *OCR-PAK* option is an enhancement to the CVIM inspection windows which provides a new capability – optical character recognition (OCR).

You configure windows for OCR using the light pen and monitor interface. When the OCR-PAK option is installed in the CVIM module, OCR is listed as an option in the Window Operations menu.



The OCR window operation can be used in either of two ways: to *read* alphanumeric characters (numbers, letters, and/or other characters), or to *verify a match* of a user-defined character string (group of characters).

The remainder of this chapter further discusses the key capabilities, requirements, and restrictions concerning the use of OCR windows.

Font Styles

Setup of the OCR window for inspections does not require that you "teach" or "train" the CVIM to recognize your character set. Instead, you select a font style (the term "font" refers to the characteristic appearance of the characters).

OCR windows **do not** recognize characters of all font styles; recognizable font styles are illustrated in Chapter 4.

Font styles *not supported* include:

- Fonts with serifs – ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789
- Italicized fonts – *ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789*
- Fonts whose characters have different stroke widths
- Any fonts generated by a dot matrix printer.

Valid Characters

The valid characters (those which are recognizable by the OCR window) for each font style include:

- Upper case alphabet A-Z
- Digits 0-9
- Slash (/), decimal point (.) or (, *international*) and space.

Space Character Restrictions

A space character is defined as a blank area *between two characters* in a character string. These restrictions apply to the space character:

- Spaces are not recognized before the first character and after the last character.
- The blank area between two characters is recognized as a single space character, regardless of the width of the blank area.

Decimal Point Character Restrictions

The OCR window recognizes either a (.) or (, *international*). as a decimal point, with these restrictions:

- Decimal points are *only* recognized between two numerals. A decimal point appearing between letters is interpreted as a *space*. A decimal point appearing at the beginning or end of a string is ignored.
- Only one decimal point is recognized per character string. Additional decimal points are interpreted as *spaces*.

Types of Operation

You can configure the OCR window to perform either of two basic types of operation – *read*, or *match*.

Read Operations

When configured for read operations, the OCR window reads character strings, and reports the characters recognized. The window passes inspection if all characters are recognized, and fails if any of the characters is not recognized. Read operations are typically used to *identify* what is being inspected.

Match Operations

When you configure an OCR window for match operation, you define a "match string." The OCR window reads character strings in order to *verify a match* with the "match string." The window passes inspection if all characters match, and fails if any of the characters in the inspected string do not match the corresponding character(s) in the match string. Match operations are typically used to *verify* what is being inspected.

You can use certain "wild card" characters in your match string; these "wild card" characters have special usage:

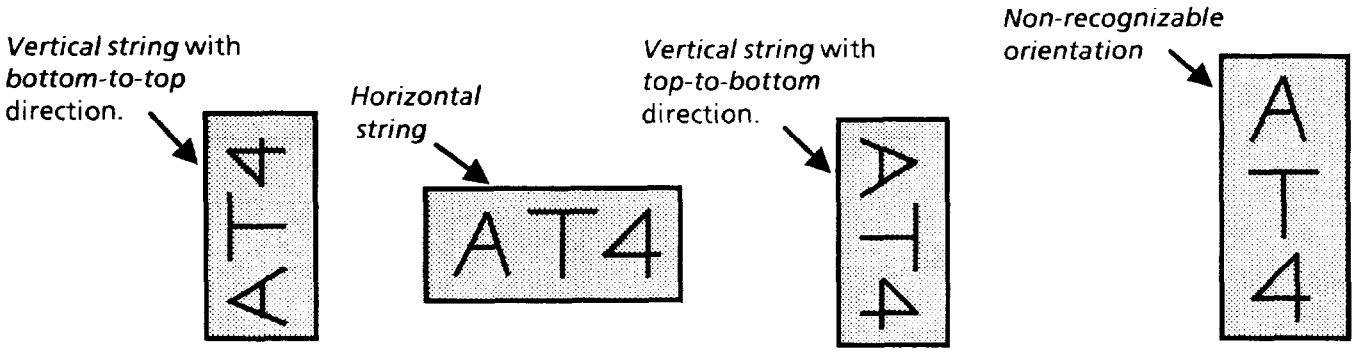
#	Accepts any number from 0-9 as a match.
@	Accepts any letter from A-Z as a match.
&	Accepts any valid character as a match.
*	Accepts any detected marking as a match.

Character Appearance Requirements

This section describes the appearance requirements which must be met for valid characters to be recognized (in addition to meeting font style requirements).

Character Orientation and Direction

The OCR window can be configured to inspect character strings having either a vertical or horizontal orientation in the field-of-view. In the case of vertically-oriented strings, you select direction – either *bottom-to-top* or *top-to-bottom*.

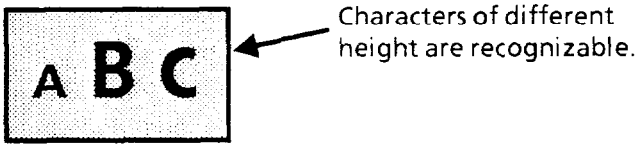


Note that, for the example on the right, you cannot inspect the string with the window positioned as shown. You could inspect the three characters by using three OCR windows, with one window over each of the characters.

Character Height

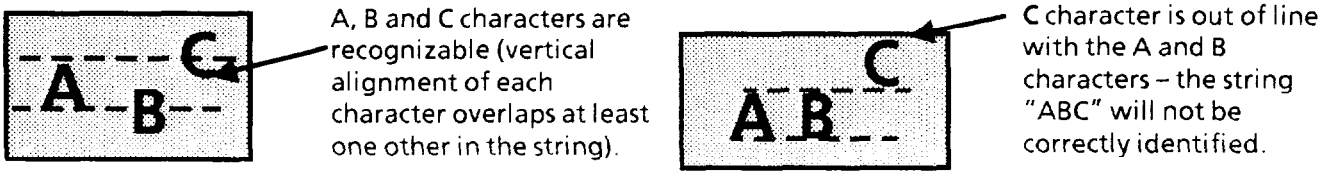
Height of characters (as they appear on the monitor during setup) must be between 11 and 127 pixels. **Note:** The optimal height range is 16-32 pixels, for maximum speed. The height range for optimal reliability is 32-64 pixels.

Note that the character size can vary, so long as all characters are within height range.



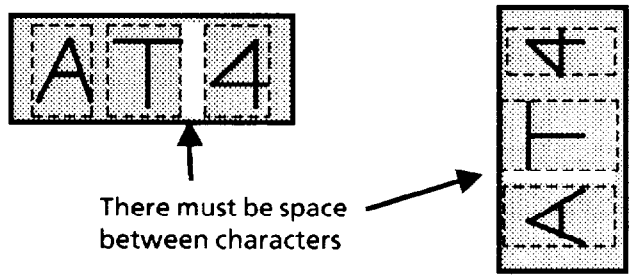
Character Alignment

Characters do not have to appear in strict linear alignment, so long as characters are not completely out of alignment with at least one other character in the string.


A, B and C characters are recognizable (vertical alignment of each character overlaps at least one other in the string).
C character is out of line with the A and B characters – the string "ABC" will not be correctly identified.

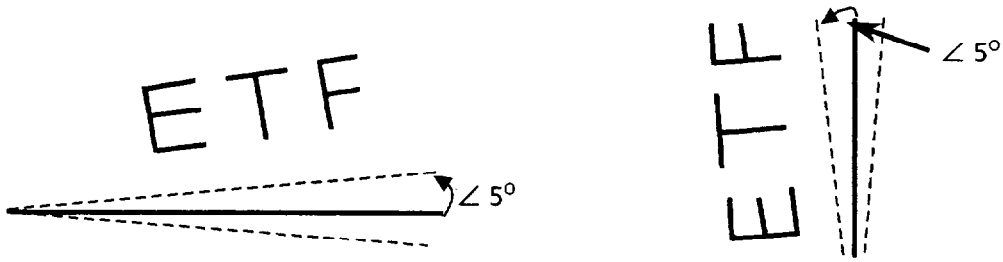
Character Spacing

Characters must be separated by blank space of at least 3 pixels in width.



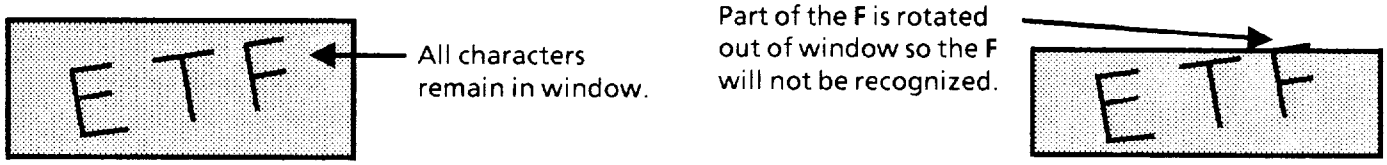
Character Rotation

The OCR windows can tolerate up to ±5 degrees of rotation of character strings, or of individual characters, from their original vertical or horizontal orientation.

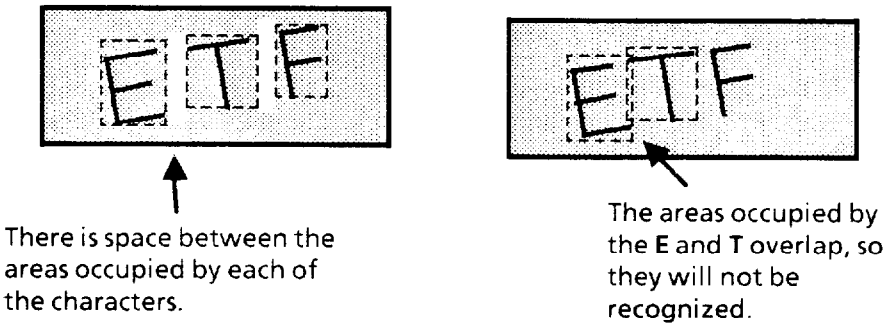


The ±5 degrees of character rotation is acceptable so long as:

- All characters remain within the borders of the OCR window during inspection.



- Characters do not overlap. That is, there must be space between the areas occupied by each character.



Character/Background Contrast

The contrast between the inspected characters and the surrounding background must be great enough so that, when configuring the OCR window, a threshold can be set to effectively distinguish the inspected characters from the background.

Character Ambiguities

There are several characters from the valid character set which can be confused by OCR systems. Certain numbers can be misread as letters, and certain letters can be misread as numbers, especially if the print quality of the inspected characters degrades. These "ambiguous" number/letter pairs are:

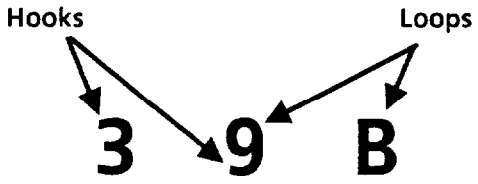
Number	Letter
0	O
1	I
2	Z
5	S
8	B

Character misreads due to confusion of the above numbers and letters can result in false inspection passes, false inspection failures, or simply incorrectly identified characters. To help prevent such misreads, for read operations, you select a priority for recognition:

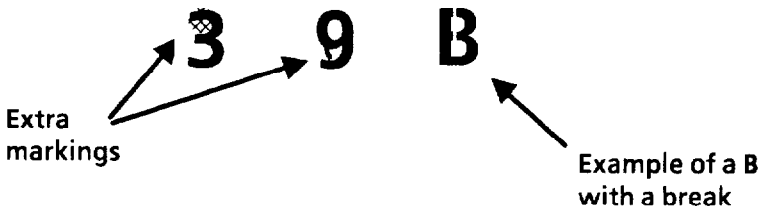
- Letters – The OCR window attempts to identify each character in the window as a letter only.
- Numbers – The OCR window attempts to identify each character in the window as a number only.
- Letters/Numbers – The OCR window attempts to identify each character in the window as a letter first. Then, if any characters are not recognized as letters, the OCR window attempts to identify them as numbers.
- Numbers/Letters – The OCR window attempts to identify each character in the window as a number first. Then, if any characters are not recognized as numbers, the OCR window attempts to identify them as letters.

Character Quality

The quality or clarity of the characters inspected can affect the success of character recognition. Extra markings or breaks in characters can result in failed or incorrect recognition of a character.



Extra markings or breaks can particularly affect parts of characters called loops and hooks. *Hooks* are parts of a character which partially encircle an area, such as the bottom half of a **9**, or the two hooks making up a **3**. *Loops* are parts of a character which completely encircle an area, such as the top of a **9**, or the two loops making up a **B**.



For example, notice the extra print in the top hook of the **3** illustrated above. With the hook filled in, the 3 is no longer recognizable. Notice also the extra print connecting the hook of the **9**, so that the character has two loops and begins to resemble an 8. The break in the B may make it unrecognizable.* Character appearance defects such as these can hinder correct identification of characters. Thus maintenance of character quality is important for enabling successful character recognition.

***Note:** The OCR-PAK includes a "reconnect" function which, when enabled, allows the OCR window to overlook small breaks in characters.

Window Usage

When you select and configure a window for OCR, the CVIM automatically allocates additional windows to support the inspection. Thus for each character string inspected, two types of window are created:

String window – This is the window you select, place over the character string to be inspected, and configure for OCR operation.

Note: You can inspect a character string up to 16 characters in length.

Typical String Window

Character Windows – These are windows automatically selected and placed by the CVIM to support the string window. Character windows are assigned to portions of the character string which appear in the string window.

Each string window can have from one to 16 associated character windows, depending on the length of the character string, and upon other configuration options.

With *Pack* enabled, character windows are assigned to characters in the string window in groups of four characters. A character string with 12 characters would require 3 character windows, with *Pack* enabled.

Typical Character Window, with *Pack* enabled

With *Pack* disabled, a character window is assigned to each character in the string window. A character string with 12 characters would require 12 character windows, with *Pack* disabled.

Typical Character Window, with *Pack* disabled

Note: Using all 24 windows, and with *Pack* enabled for all windows, you could inspect up to 76 characters per tool set.

Window Usage (continued)

Character Window Requirements – In order to configure a string window for OCR, there must be enough additional windows available to serve as character windows.

To be available to serve as character windows, the additional windows must:

- Follow the string window in sequence.
- Be disabled.
- Not have OCR selected for window operation.

For example, if you select window 5 for use as the string window, and your inspection requires 3 character windows, then windows 6, 7, and 8 must be available for use as character windows – that is, they must be disabled and not have OCR selected as the window operation.

Additional Features

Listed below are additional features of the OCR windows:

- **Light/Dark Background**: You can configure the OCR window to look for either light characters on a dark background, or dark characters on a light background.
- **Mirror**: You can configure the OCR window to recognize a mirrored image of inspected characters.
- **Search Window:** The OCR-PAK option provides a shift compensation feature called a "search window" which works exclusively with the OCR windows.
- **Individual Character Thresholding:** You can set the threshold for each character window. With packing disabled, a character window is assigned to each character, so you can set the threshold for each character.
- **Automatic Character Reconnect**: You can configure the OCR window to overlook small breaks in the strokes of characters which would ordinarily result in a character not being recognized.
- **Manual Character Width Setting**: You can set a limit for character width, which allows the OCR window to separate and recognize connected characters which would ordinarily not be recognized.

Chapter 3 Installing the OCR-PAK Option

Chapter Objectives

The objective of this chapter is to describe how to install the OCR-PAK option in the Allen-Bradley 5370-CVIM machine vision system.

Installing the OCR-PAK Option

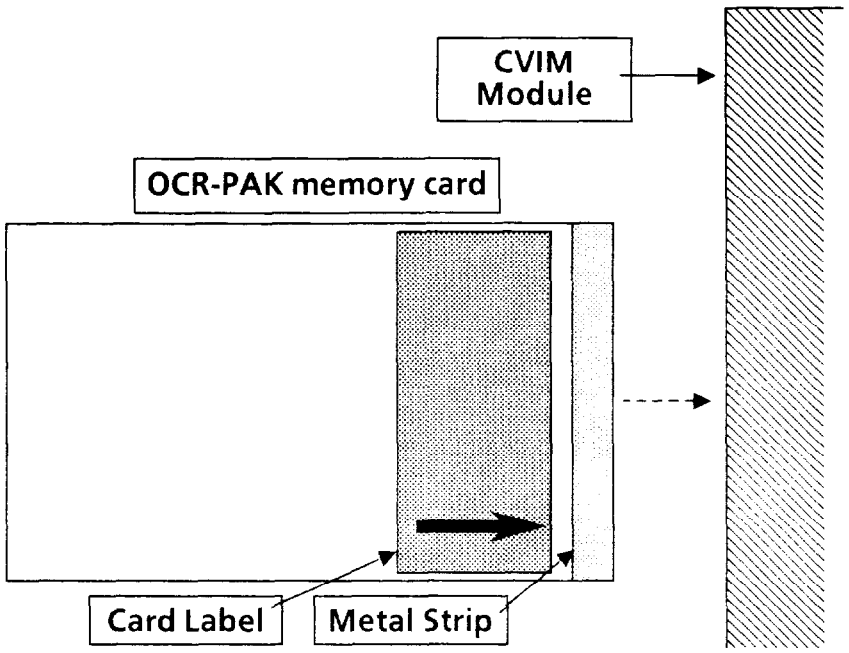
The OCR-PAK option is provided on a memory card. This section describes how to install the option.

Note: If you have already installed or intend to install other software option packages in the CVIM module, refer to the Instruction Sheet included with the software package for the proper loading sequence for installing multiple options.

Also note that the CVIM system must have the Revision C03 (or higher) firmware before the OCR-PAK option can be installed (the firmware revision is listed on the title banner on the monitor screen following powerup).

Use the following steps to install the OCR-PAK option in your CVIM system.

Your Action	Comments
Pull the DC/PWR LOCK *handle out as far as it will go.*	This removes DC power from the CVIM module.
Insert the memory card into the Archive Memory *slot on the CVIM module.*	Insert the end with the metal strip facing right (the arrow on the card label should also be facing right.)

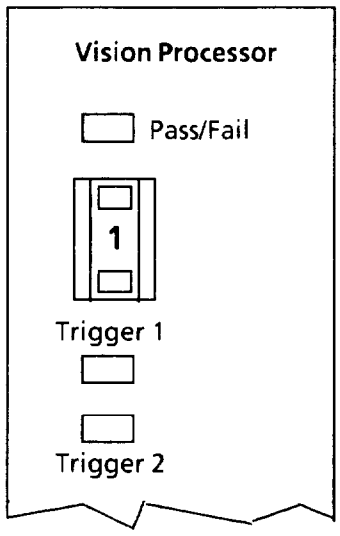


Push in the DC/PWR LOCK *handle as far as possible.*	This applies DC power to the CVIM module; when power is applied, the loading sequence begins .

Installing OCR-PAK
(continued)

CAUTION: Do not remove power to the CVIM module during loading of the OCR-PAK option. Doing so may damage the CVIM module.

Your Action	Comments
Observe the LEDs during loading.	The top three LEDs on the CVIM module indicate the progress of the three-phase loading process, as follows:



LEDs	OCR Loading Phase		
	1	2	3
Pass/Fail	Red-to-yellow-to-green.	Green	Red-to-yellow-to-green.
Trigger 1	Green	Green	Off
Trigger 2	Off	Green	Green

The loading process requires about 45 seconds, with each phase taking about 15 seconds. When the loading process is complete, the CVIM module begins its normal powerup sequence. To verify that the OCR-PAK option is installed, check the title banner on the monitor after power-up; if the OCR-PAK option is installed, there is a message on the banner indicating the presence of the OCR-PAK option.

Note: You need only install the OCR-PAK option once; once installed, the OCR-PAK option remains installed for all subsequent powerups.

Chapter 4 Configuring OCR Windows

Chapter Objective

The objective of this chapter is to describe how to configure a window for OCR inspections.

Using OCR Windows

The OCR-PAK option is integrated into the CVIM module as an additional function performed by inspection windows.

To set up an OCR window, a number of steps are involved. Each of these steps are discussed in this chapter:

- *Acquire an image* for use during setup.
- *Begin setup* by selecting and enabling a window, selecting *OCR* as the window operation, placing the window, and setting an initial threshold level for the window.
- *Continue the setup process* by selecting the *Font* style, selecting the *Read* setting, and defining the *Search Mode*. (Optional) Use the *Learn* function to check the results of your configuration to this point.
- *Determine the number of windows allocated* for the inspection by setting the *maximum characters*, and by setting the *pack* function. (Optional) Use the *Learn* function and the *Next* box to check the windows allocated.
- *Enable and place the search window*, if used. The search window is a shift compensation feature that is part of the OCR option package, and works exclusively with OCR windows.
- *Assign a reference tool*, if appropriate.
- *Select discrete outputs* for the OCR window, if used.

Acquiring an Image

Before you configure windows for *OCR* operation, you should first *acquire an image* which includes the characters to be inspected.

Note: Refer to the *CVIM User Manual* for general information on staging and on acquiring an image.

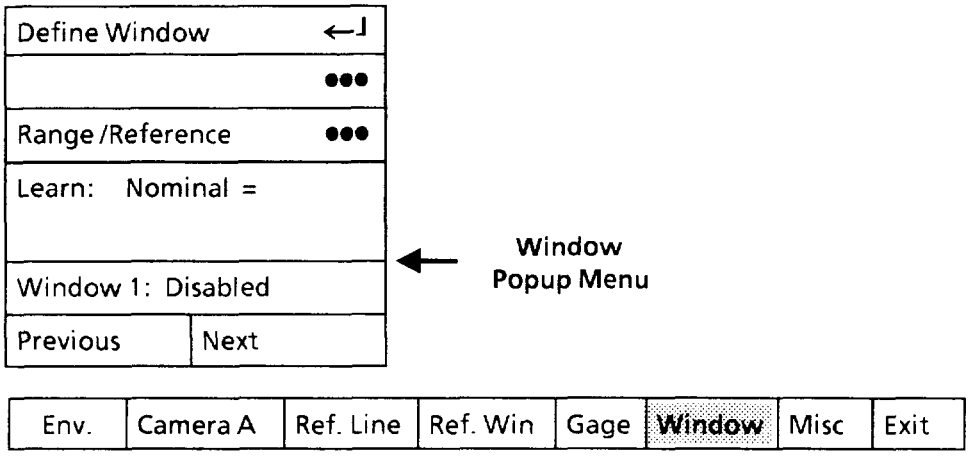
Initial Setup of the OCR Window

After you have acquired an image for OCR setup, you can begin to configure a window for OCR. This section discusses the *initial* steps of window setup – selecting and enabling a window, selecting OCR for the operation type, placing the window, and setting an initial threshold level.

Initial Setup of the OCR Window (continued)

To begin configuring an inspection window for OCR operation, first access the *Window* menu.

Your Action	Comments
Pick the Window *box on the* Main *menu.*	When you pick the Window box, the *Window* menu appears.



Select and Enable the Window

In order to select a specific window for OCR operation, you pick the Next or Previous box on the *Window* menu, as with any other window operation. However, in selecting a window for OCR operation, remember that, for OCR inspections, the CVIM uses multiple windows:

- The first window is the "string window"; this is the window you *select*, *enable*, and *configure* for OCR.
- The subsequent windows are the "character windows"; these are allocated by the CVIM automatically on an as-needed basis when you configure the *string* window.

In order to allocate character windows, the CVIM utilizes only consecutively-numbered disabled windows, which must immediately follow the string window in sequence. Each *string* window can require from one to 16 character windows. Therefore, when selecting a window to be your *string* window, select a window which is followed in sequence by at least one *disabled* window, *and possibly more*, depending on how parameters in your OCR window configuration are set.

Select and Enable the Window (continued)

The number of character windows required depends upon these two parameters which you set: (1) the maximum number of characters; and (2) the *pack* function – *enabled* or *disabled*. (**Note:** The *pack* function is discussed later in this chapter. Briefly, with packing *enabled*, each character window used is assigned to a group of up to four characters; with packing *disabled*, one character window is assigned to each individual character in the string).

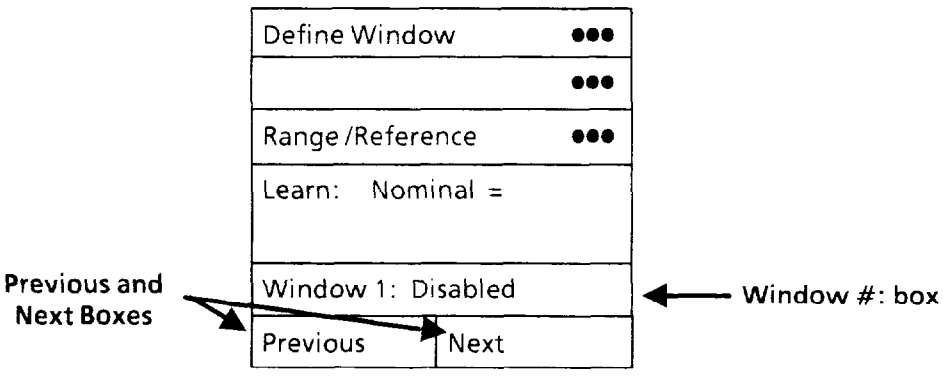
Recall that there are 24 windows in all (per tool set). The CVIM module only allocates windows with higher numbers than the string window as character windows. Thus, for example, if a string window requires six character windows, the highest-numbered window you can select for the string window is 18; in that case, the CVIM module would then use windows 19-24 for character windows. **Note:** You cannot use window 24 for an OCR *string* window, since there are no higher-numbered windows available.

Note: The OCR-PAK option does not allocate a *disabled* window which is set for *OCR* operation when allocating character windows.

Each character window, when allocated, is automatically *enabled or disabled* as required *(*the Window #: box on the Window menu will read Enabled or Disabled *in dark lettering,* indicating that you cannot change the parameter in the box*)*. You cannot disable or enable individual character windows; you can only disable or enable the associated string window.

Once you have decided which window to use as a *string* window, select and enable the window.

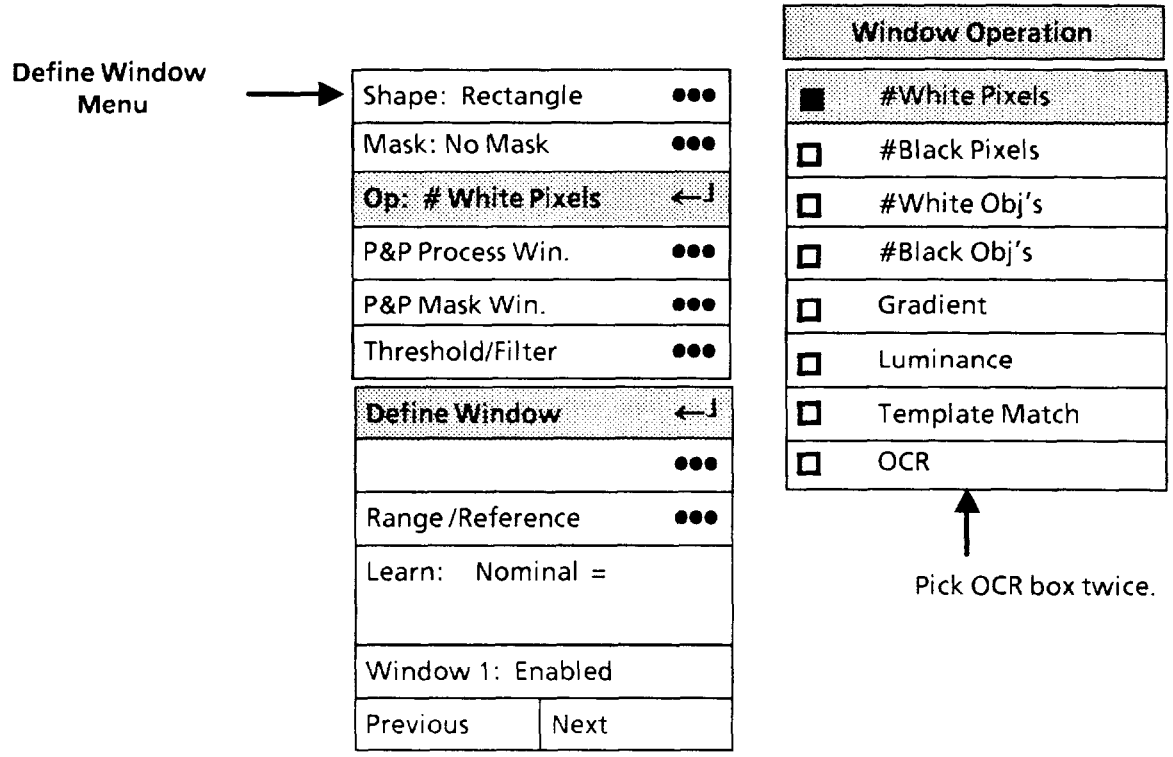
Your Action	Comments
Pick the Next *or* Previous *box on the* Window *menu to select the desired window.*	
Pick the Window #: Disabled *box to* enable *the window.*	



Selecting OCR Operation

Access the Define Window and Window Operation menus in order to select OCR for the window operation.

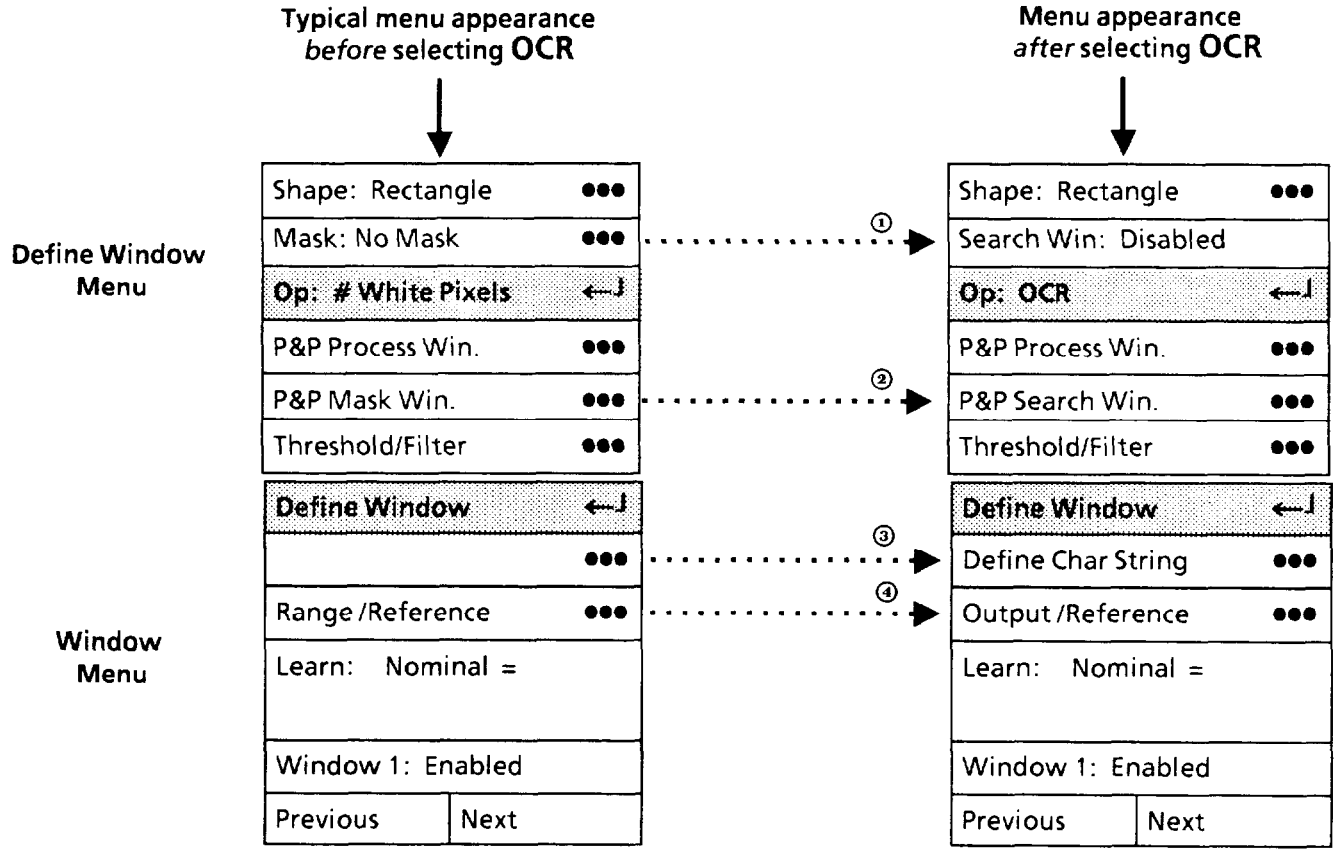
Your Action	Comments
Pick the Define Window *box on the* Window *menu.*	When you pick the Define Window box, the Define Window menu appears. In order to select OCR as the operation, access the Window Operation menu (do this by picking the Op: box). Note that, before you can select OCR as the window operation, two boxes on the Define Window menu must be set, as follows: • The Shape: box must be set to Rectangle. • The Mask: box must be set to No Mask.
Pick the Op: *box on the* Define Window *menu.*	When you pick the Op: box, the Window Operation menu appears (typical menus shown below):



Pick the OCR *box on the* Window Operation *menu twice.*	Picking the OCR box twice changes the Op: box setting to OCR. **Note:** If you cannot select OCR as the operation (that is, if OCR appears on the Window Operation menu in black letters), and the Shape: and Mask: boxes are set correctly, check the next window. The next window is either enabled, or if it is disabled, OCR has been selected for its window operation. You must either select a different window, or change the configuration of the next window so that it is disabled and OCR is not its selected operation.

Selecting OCR Operation *(continued)*

When you select OCR as the window operation, note the contents of both the Window and Define Window menus change, as shown below (the specific changes are indicated by the dotted-line arrows):



① The Mask: box is replaced by the Search Win: box (mask windows are not available with OCR operation. A new reference tool, the *search* window, becomes available).

② The P&P Mask Win.: box is replaced by the P&P Search Win.: box.

③ The Define Char String box is added to Window menu (when you pick this box, the Define Char String menu appears, which you use to define the OCR operation).

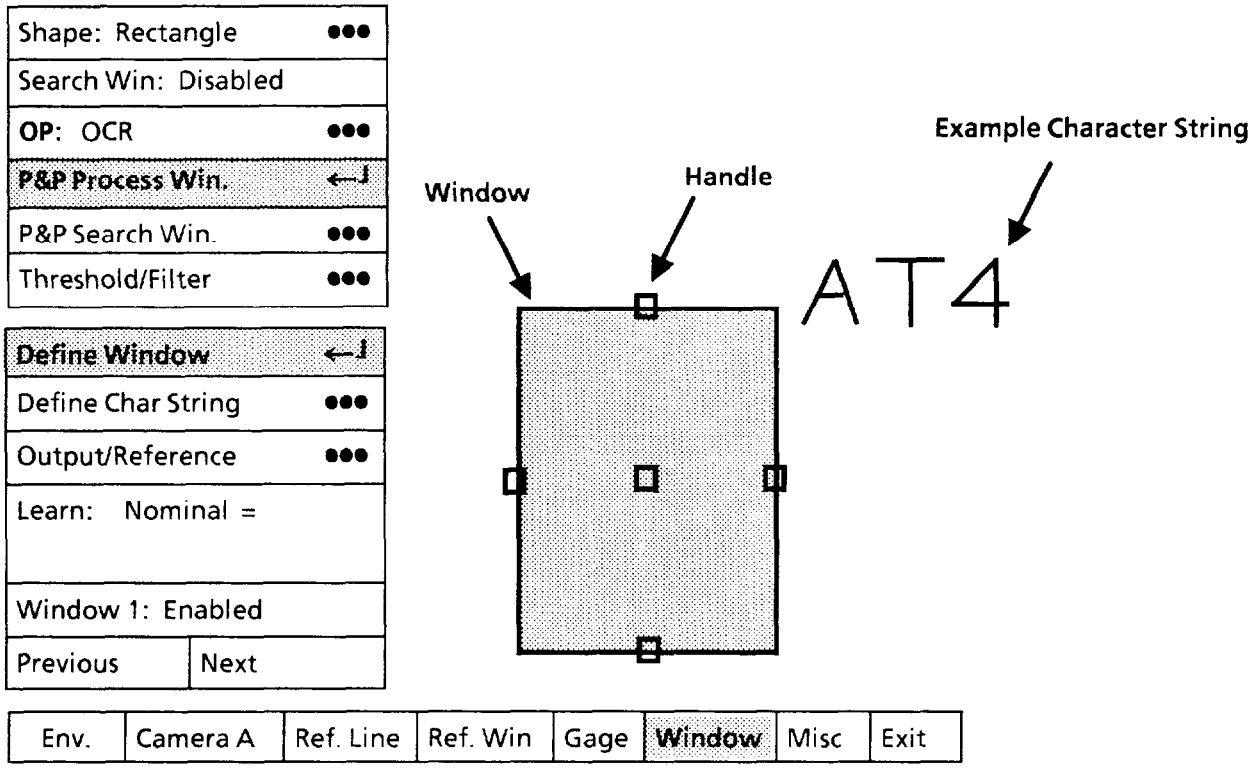
④ The Range / Reference: box changes to the Output / Reference: box (ranges are not used with the OCR windows).

These new OCR-related menu items are discussed further throughout the remainder of this chapter.

Placing the OCR Window

After OCR is selected, next place the OCR window to cover the character(s) you are going to inspect.

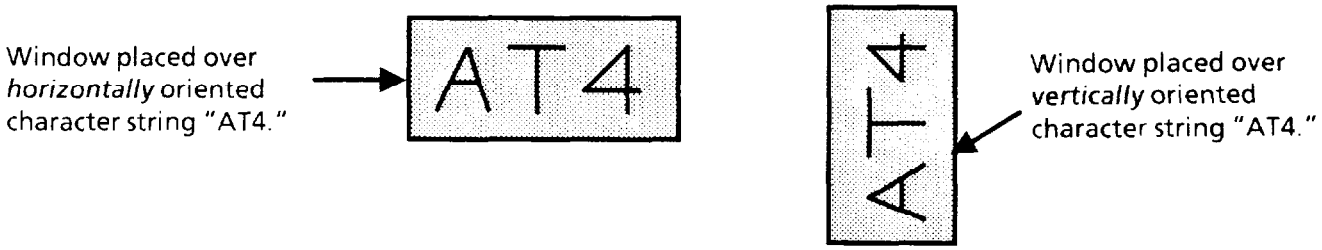
Your Action	Comments
Pick the P&P Process Win. *box on the* Define Window *menu.*	When you pick the P&P Process Win. box, the "handles" appear on the window.



Pick and place the window so it covers the character(s) you are gong to inspect.

The window should be placed so the window surrounds the character(s) to be inspected. In placing the window:

- Do not allow the window borders to overlap any part of the character(s) to be inspected.
- Make sure the characters(s) to be inspected are the only features that appear in the window.


Window placed over *horizontally* oriented character string "AT4."
AT4
AT4
Window placed over *vertically* oriented character string "AT4."

Placing the OCR Window (continued)

As you place the OCR window over the character string, you can use the OCR window, along with the *Help* message, to determine the size of the characters in your image. Remember that the characters' size must be between 11 and 127 pixels in height.

Your Action	Comments
Place the window over a character so that the window just covers the character.	

Pick the Help *icon to display the window dimensions.*

When you pick the *Help* icon, the help message box appears; the help message lists the window coordinates, along with the height and length:

Typical help screen showing window coordinates.

```
Window Coordinates: X = 100, Y = 100
Length = 12, Height = 16
```

Note the Length *and* Height *dimensions.*

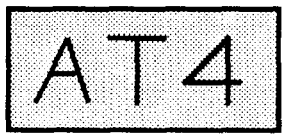
Because the window encompasses the dimensions of the character, the *window* height and length reflect the *character* height and width, respectively. Compare the character height and width with the specified size requirements to see if they are within range. In most cases the character *height* will be the key dimension for comparison. **Note:** For vertically-oriented characters, the window *length* indicates the character height, while the window *height* reflects the character width.

Also, if character size is uniform, it is only necessary to measure one representative character. If character size is not uniform, measure the largest and smallest characters to determine if they are within the size limit.

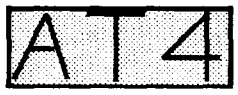
Placing the OCR Window *(continued)*

When you place the OCR window, you may want to include enough space within the window surrounding the inspected characters to allow for slight shifting of the character(s) from inspection to inspection. If the characters' position in the image shifts so that part of a character is outside the window or on the border, that character will not be recognized.

Window placed with some tolerance for shifting →



Window placed with no tolerance for shifting (not recommended) →

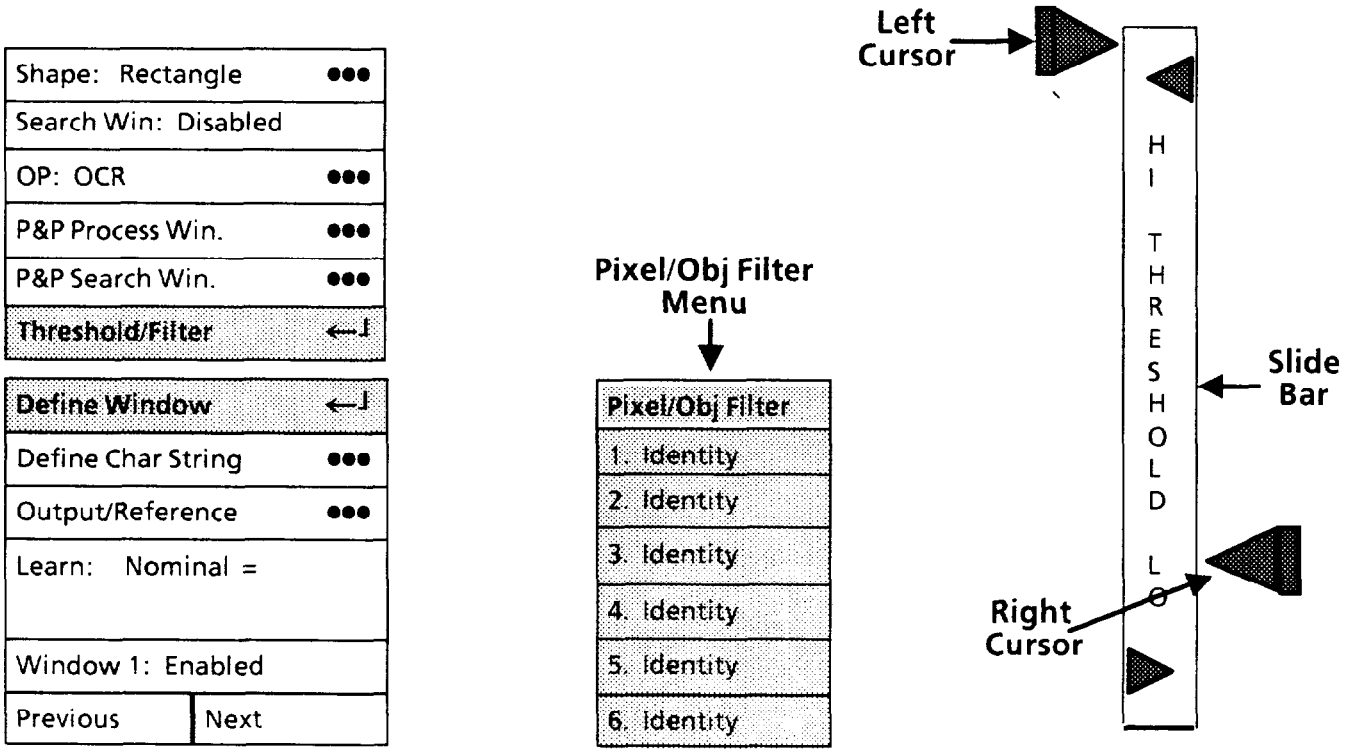


If significant shifting occurs in your application, you can use the CVIM reference tools to provide shift compensation for the OCR windows. Also, the OCR-PAK option provides another shift compensation feature, called the *search* window, which works exclusively with OCR windows. See *Using the Search Window* and *Assigning the Reference Tool* later in this chapter for more information.

Adjusting the Threshold

As with other windows, you can adjust the binary threshold of the OCR windows to obtain the best possible image of the inspected character(s). Select the Threshold / Filter box on the Define Window menu to set the threshold.

Your Action	Comments
Pick the Threshold/Filter *menu box in the* Define Window *menu.*	When you pick the Threshold Filter box, the threshold-adjusting slide bar appears on the screen. **Note:** The Pixel / Obj Filter menu and the cursor left of the slide bar are disabled, and cannot be used when you are configuring OCR.



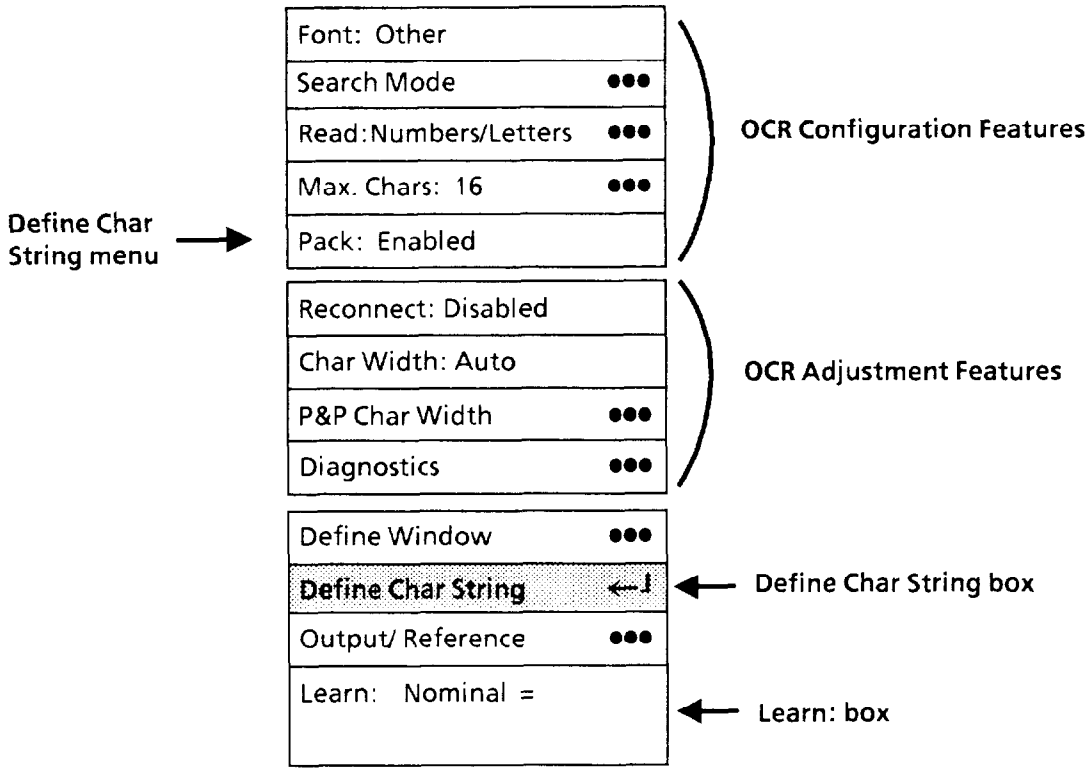
Adjusting the Threshold (continued)

Your Action	Comments
Pick the right cursor (next to the slide bar).	When the cursor is successfully picked, it changes color.
Adjust cursor to obtain the best image possible.	When you slide the right cursor *upward*, more dark pixels appear in the window, and dark characters on a light background appear thicker. Light characters on a dark background appear thinner. When you slide the right cursor *downward*, more light pixels appear in the window, and light characters on a dark background appear thicker. Dark characters on a light background appear thinner. When setting the cursor position, your objectives are to: 1. Obtain a clearly readable appearance of characters. Varying the threshold level can make character strokes appear thinner or thicker, fill in loops or hooks, etc. 2. Make sure the string window is clear as possible of any noise (that is, random pixels, of the same color as the characters, appearing in the OCR window). Some noise is tolerable; however, too much noise can cause misreads by the OCR window. **Note:** When you set the string window threshold level, you are also setting the threshold for all of the individual character windows as well. You can also set the threshold level for each of the individual character windows (see *Setting the Pack Function* later in this chapter).

Using the Define Char String Menu

To further configure the OCR window, you must use the Define Char String menu. To access the Define Char String menu, pick the Define Char String box on the Window menu.

Your Action	Comments
Pick the Define Char String *box on the* Window *menu.*	When you pick the Define Char String box, the Define Char String menu pops up. There are two types of features on the Define Char String menu – the *OCR configuration* features, and the *OCR adjustment* features.



The *OCR configuration* features are used to set most of the parameters for the OCR inspection, and are discussed in this section. The *OCR adjustment* features are intended for use only in special cases and are discussed in Chapter 5.

Use of the Learn: box during setup will also be discussed in this chapter. Before you can use the Learn: box to display meaningful results during setup of the OCR window, you will have to appropriately set at least these three Define Char String menu items:

- Font
- Search Mode
- Read

These three parameters are discussed in three sections that immediately follow; after that, the Learn: box, and the remaining parameters, are discussed.

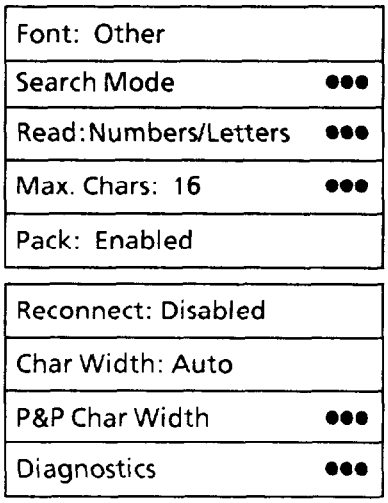
Selecting the Font

The Font: box allows you to select one of two font choices, ANSI or Other. Select ANSI if you are inspecting ANSI (also called "OCR A") characters; otherwise select Other.

Note: If you select Other, recall that, as discussed in Chapter 2, there are restrictions to the styles of font that the OCR windows can consistently recognize. Make sure your font style conforms to these restrictions.

Your Action	Comments
If appropriate, pick the Font: *box on the* Define Char String *menu to change the Font.*	Picking the Font: box toggles the Font selection between ANSI and Other.
Pick the desired Style *on the* Font *menu.*	

Font: box →



ANSI – This is the ANSI (American National Standards Institute) or OCR A font:

ABCDEFGHIJKLMNOPQRSTUVWXYZ / 0123456789

Other – Below are two examples of fonts that are recognizable when Other is selected:

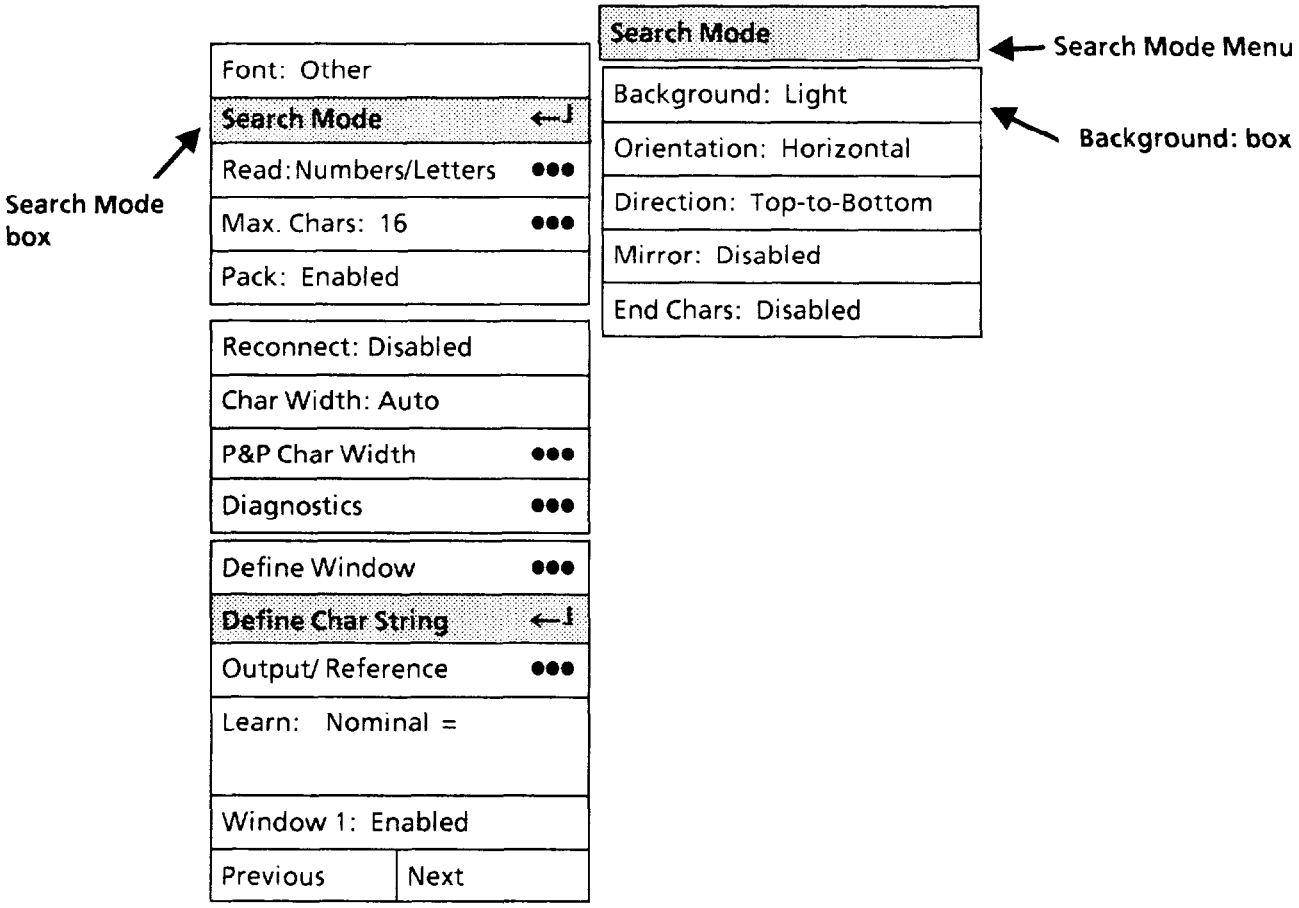
Modern ABCDEFGHIJKLMNOPQRSTUVWXYZ / 0123456789

Helvetica ABCDEFGHIJKLMNOPQRSTUVWXYZ / 0123456789

Defining the Search Mode

The Search Mode menu allows you to select a number of parameters which govern the way the CVIM searches for characters within the string window. Access the Search Mode menu by picking the Search Mode: box.

Your Action	Comments
Pick the Search Mode *box on the* Define Char String *menu.*	Picking the Search Mode box displays the Search Mode menu, as illustrated below:



Selecting Background

Pick the Background: *box on the* Search Mode *menu to change the setting, if appropriate.*	Picking the Background: box toggles the entry between Light and Dark. Select Background: Light to inspect dark characters on a light background. Select Background: Dark to inspect light characters on a dark background.

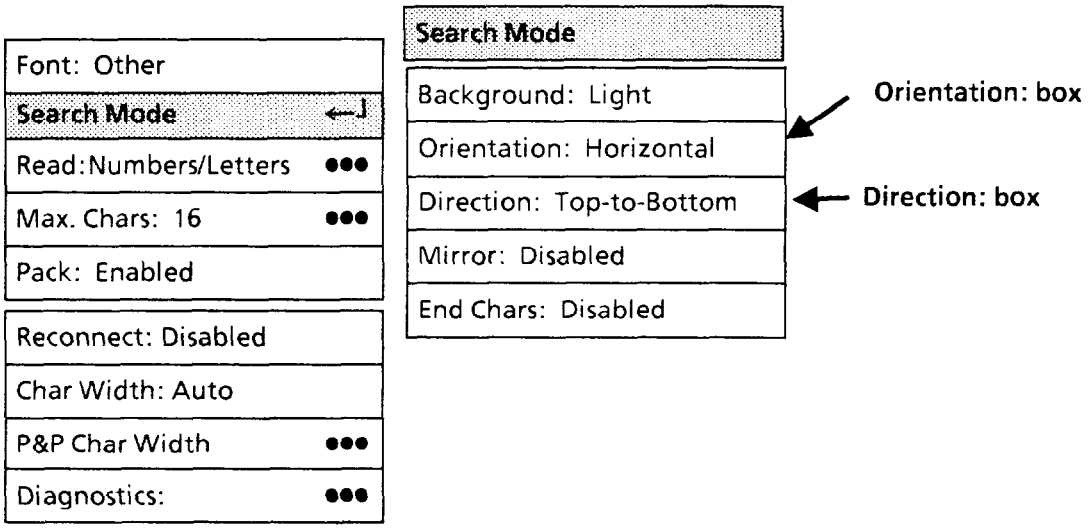
Window placed over *dark characters* on a *light* background.

Window placed over *light characters* on a *dark* background.

Defining the Search Mode *(continued)*

Selecting Orientation *and* Direction

Set the Orientation: and Direction: boxes on the Search Mode menu according to the orientation and direction of the character strings you are inspecting, as described below:

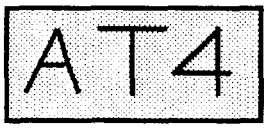


Your Action

Pick the Orientation: *box on the* Search Mode *menu to change the setting, if appropriate.*

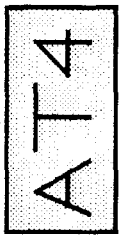
Picking the Orientation: box toggles the entry between Horizontal and Vertical. Select Horizontal to inspect horizontally-oriented characters. **Note:** With Horizontal selected, the Direction: box is disabled. This is because the CVIM normally recognizes characters in horizontal strings from left-to-right (except with Mirror: *enabled*; see *Using the Mirror Function*).

Window placed over *horizontally*-oriented characters →

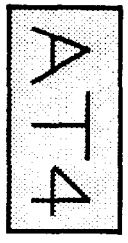


Select Vertical to inspect vertically-oriented strings (shown below). If you select Vertical, you also choose the Direction. **Note:** With Vertical selected, the Direction: box is *enabled.*

Window placed over *vertically*-oriented characters with *bottom-to-top* direction. →



Window placed over *vertically*-oriented characters with *top-to-bottom* direction. →



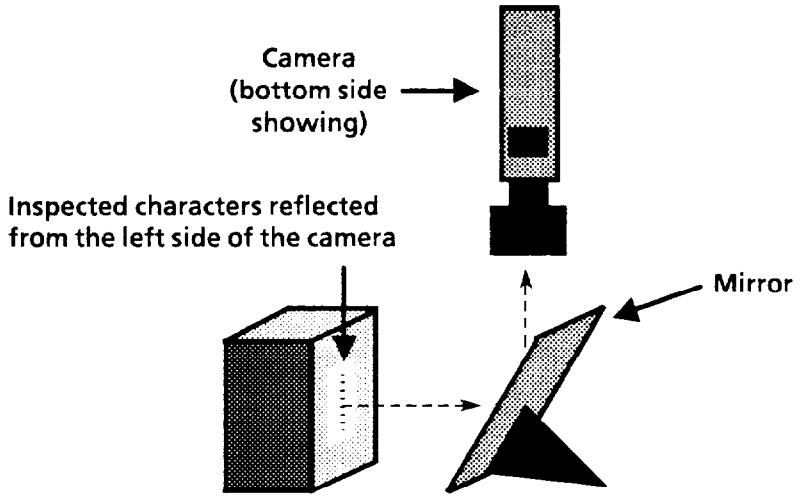
Pick the Direction: *box on the* Search Mode *menu to change the setting, if appropriate.*

Picking the Direction: box toggles the entry between Bottom-to-Top and Top-to-Bottom. Select the Direction which is appropriate for your application (see diagram above for examples of Bottom-to-Top and Top-to-Bottom directions).

Defining the Search Mode *(continued)*

Using the Mirror *Function*

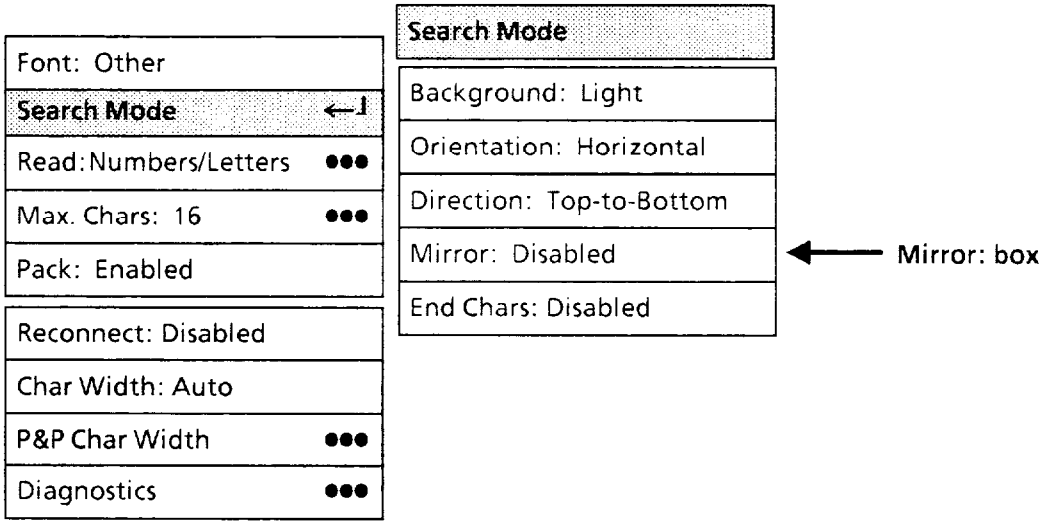
The Mirror function allows you to inspect a reversed image of character strings. For example, with Mirror: set to Enabled, you can use a mirror to reflect the character strings to the camera, or inspect characters on the reverse side of a transparent film.



The Mirror function is designed for cases where the image is reflected from *either the left or the right* of the camera field of view (that is, the image is reflected about the vertical axis in the field of view – see diagrams on the next page). The mirror function is **not** designed to work with images reflected from above or below the field of view.

You enable the Mirror function by picking the Mirror box on the Search Mode menu.

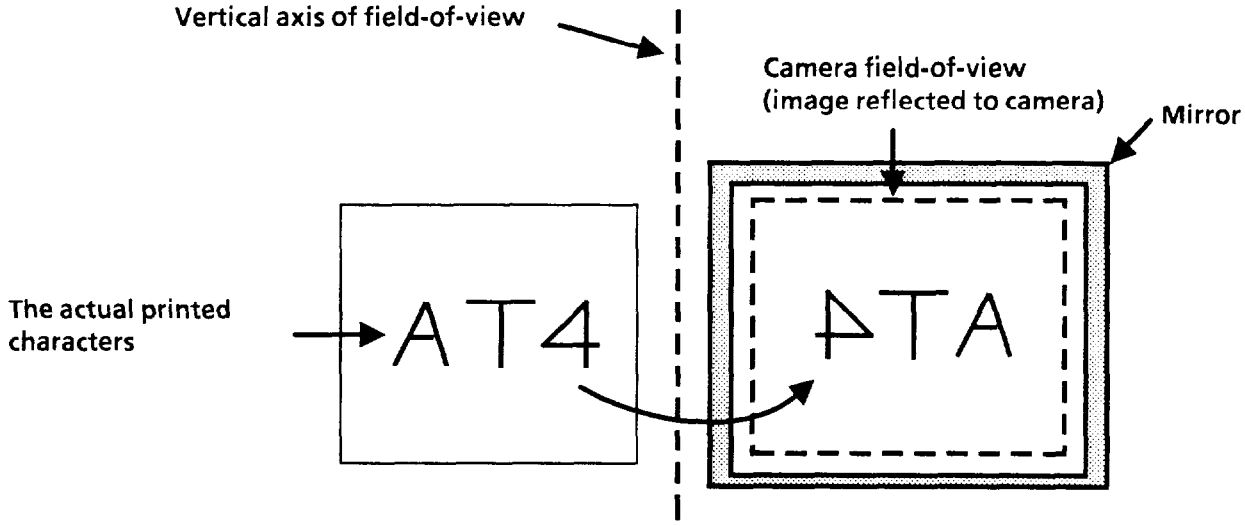
Your Action	Comments
Pick the Mirror: *box on the* Search Mode *menu to change the setting, if required.*	Picking the Mirror: box toggles the entry between Enabled and Disabled.



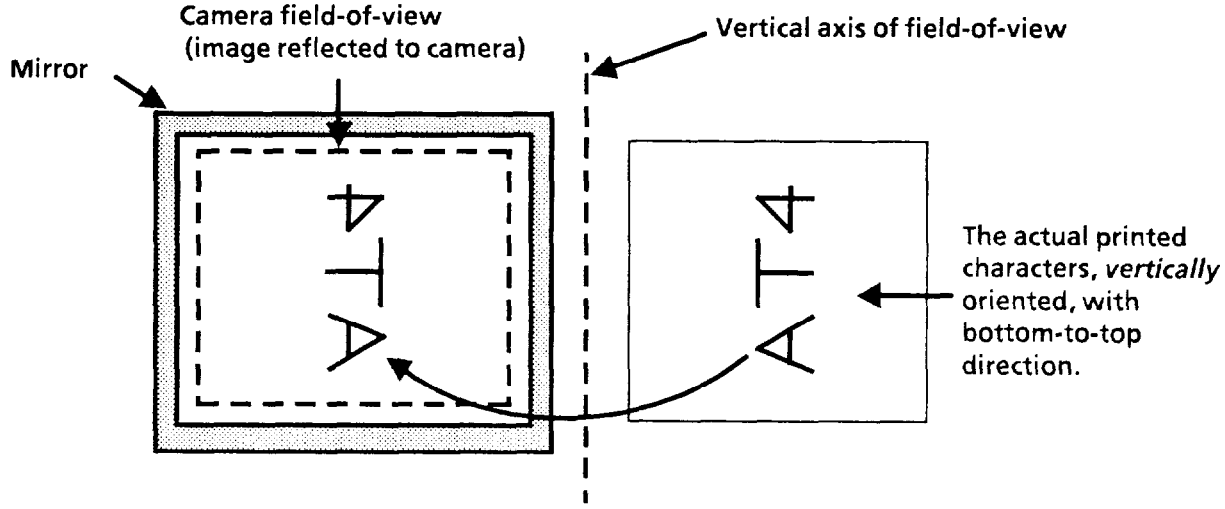
Defining the Search Mode *(continued)*

Using the Mirror *Function*

The following examples show mirror and reflection orientation:

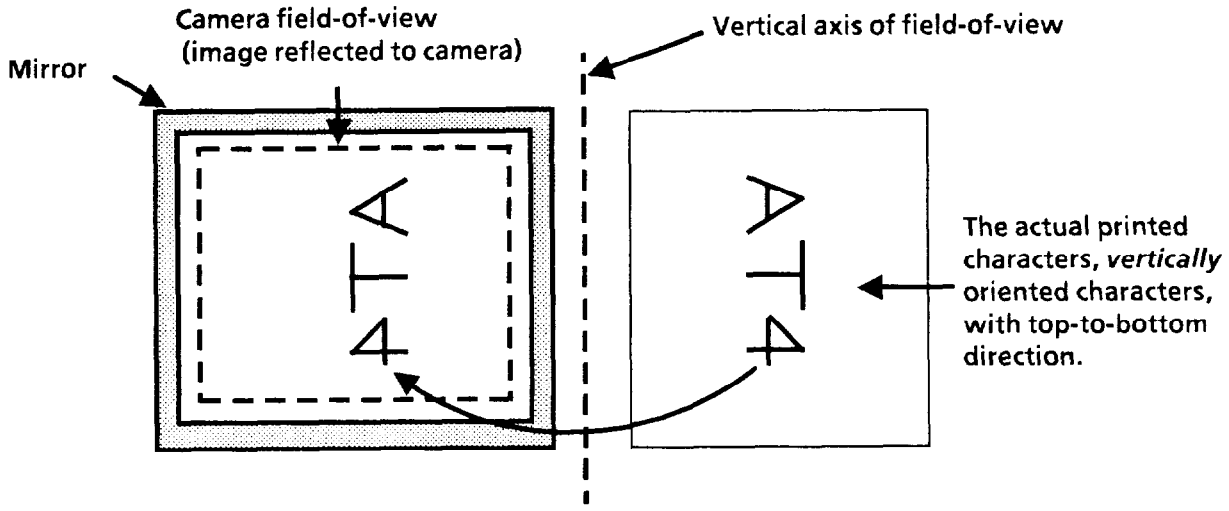


Horizontal Characters: In this case, the image is reflected from the left of the camera field of view, and about the vertical axis of the field-of-view (the reflected image would be the same if the image was reflected from the right).



Vertical Characters – Bottom-to-top: In the above case, the image is reflected from the right of the camera field of view, and about the vertical axis of the field-of-view (the reflected image would be the same if the image was reflected from the left). To inspect the string, you would select Orientation: Vertical, and Direction: Bottom-to-top.

Defining the Search Mode *(continued)* *Using the* Mirror *Function*



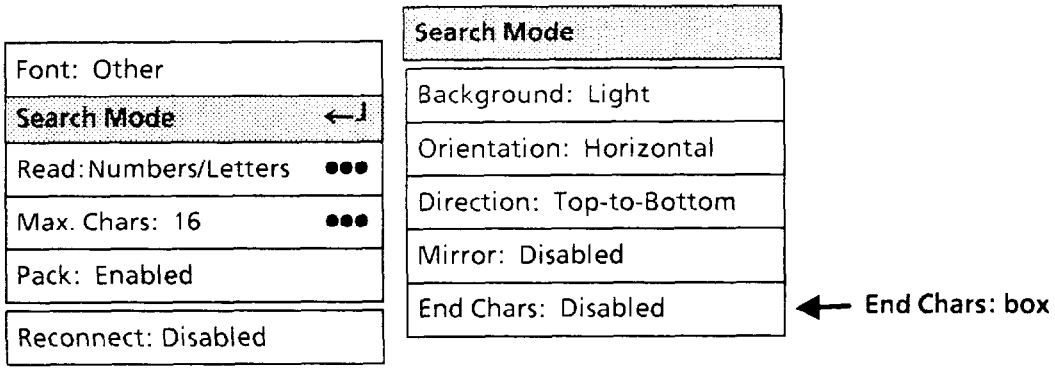
Vertical Characters – Top-to-Bottom: In the above case, the image is reflected from the right of the camera field of view (the reflected image would be the same if the image was reflected from the left). To inspect the string, you would select Orientation: Vertical, and Direction: Top-to-Bottom.

The End Chars *Function*

The End Chars function works in conjunction with the Max Chars function and affects the way OCR windows are utilized. For more information, refer to "Setting Max. Chars," and to the subsection, "Effect of the End Chars Setting," in this chapter.

To enable or disable the End Chars function:

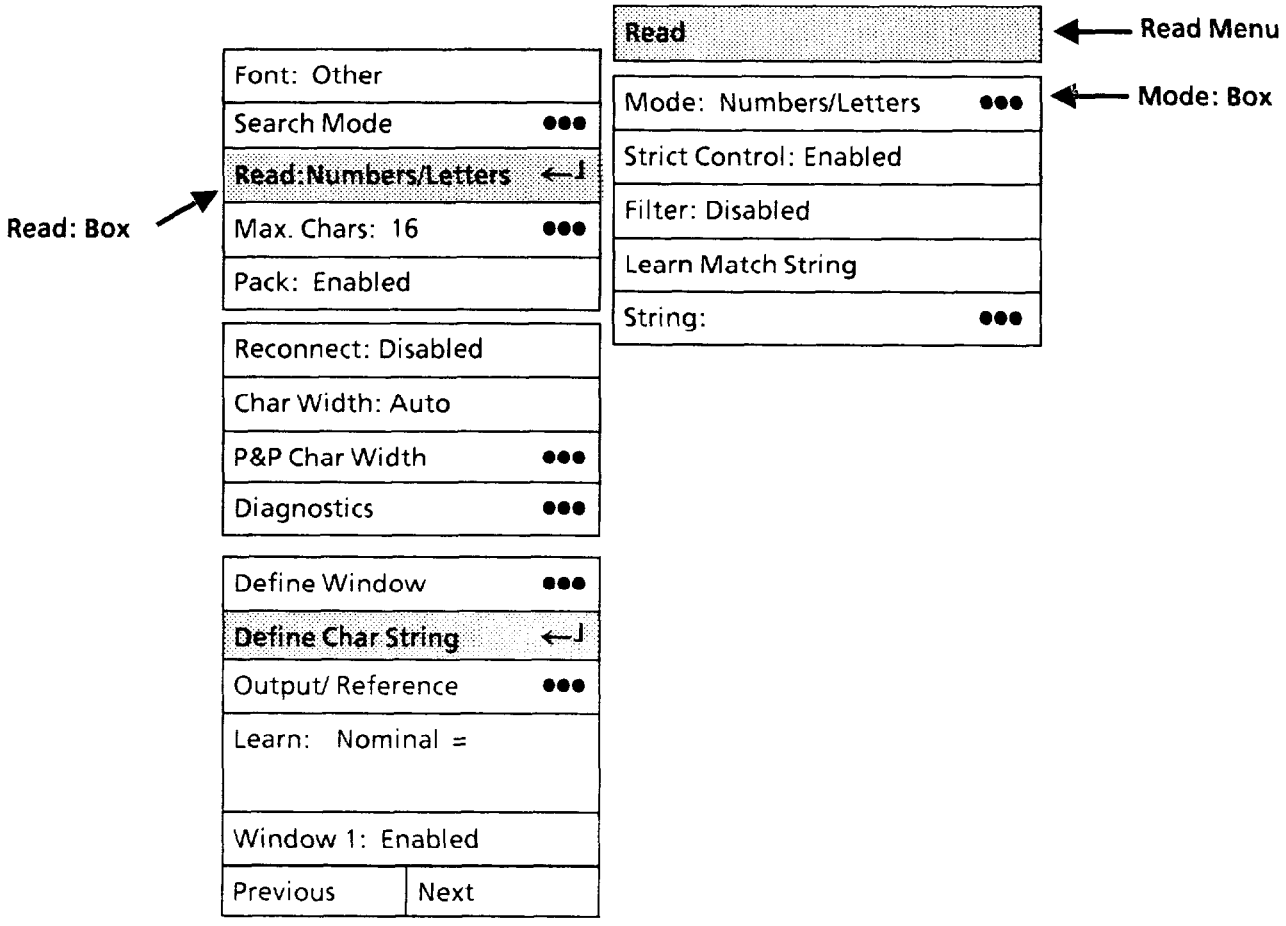
Your Action	Comments
Pick the End Chars: *box on the* Search Mode *menu to change the setting.*	Picking the End Chars : box toggles the entry between Enabled and Disabled.



Selecting the Read *Mode*

Select the Read: box to access the Read: menu, then select from parameters listed in that menu.

Your Action	Comments
Look at the setting in the Read: *box on the* Define Char String *menu.*	The Read: box tells what mode is currently selected. It can be any one of these: Letters, Numbers, Letters/Numbers, Numbers/Letters, or Match String.
Pick the Read: *box on the* Define Char String *menu.*	Picking the Read: box displays the Read menu. The Mode box is set to Numbers/Letters the first time you access the Read menu. **Note:** The four other boxes on the Read menu are disabled (the lettering is dark), unless Match String is selected for the Mode. These four boxes are used only when Match String is selected for the Mode.



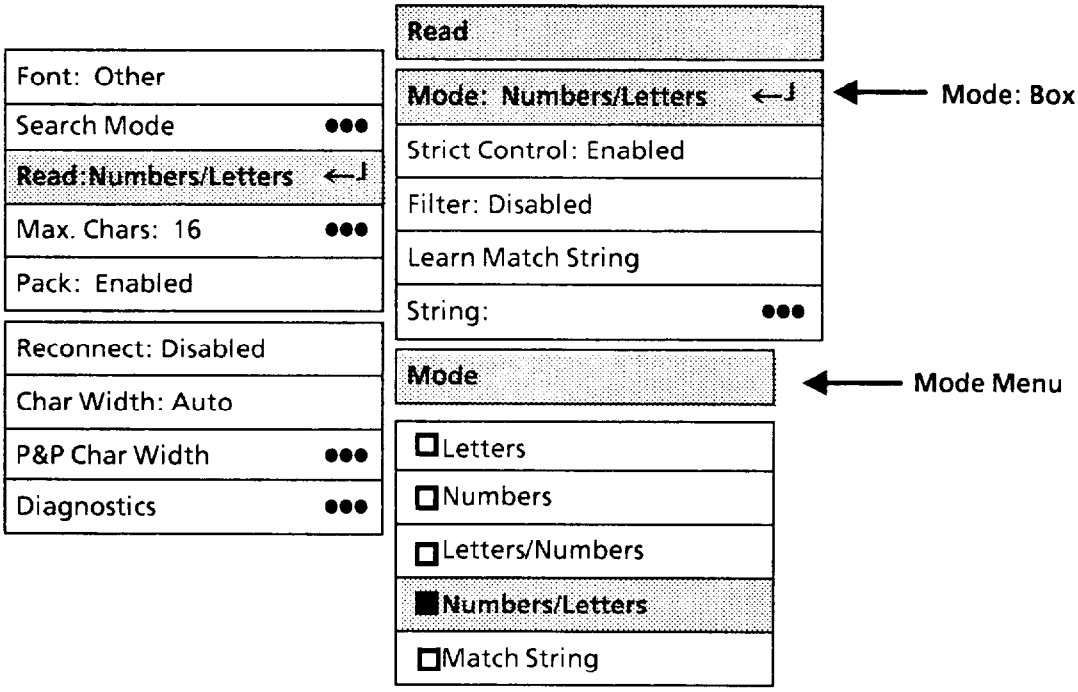
Selecting the Read *Mode (continued)*

To change the Mode: box setting, pick the Mode: box to access the Mode menu.

Your Action

Pick the Mode: *box on the* Match Mode *menu.*

Picking the Mode: box displays the Mode menu.



Pick the box on the Mode *menu to select the item which is appropriate for your application.*

Pick the appropriate item on the Mode menu for your application. When you pick an item on the Mode menu, the box for that item turns dark, and the selected item appears in the Mode: box.

Choosing the Mode

There are two "modes" of operation that the OCR window can perform – either a "read," or a "match" operation.

Read: If you select any of the first four items on the Mode menu – Letters, Numbers, Letters/Numbers, or Numbers/Letters – as the mode, you are selecting a "read" operation. The OCR window identifies and lists the characters which appear in the OCR window during inspection. The window's discrete output result is a "pass" if the OCR window identifies all the characters in the window.

Match: If you select Match String as the mode, you are selecting a "match" operation; when the OCR window inspects each character string, it determines if there is an exact *match* between the characters inspected in the window, and a user-defined character string (called the "match string"). The window's discrete output result is a "pass" if the character string identified by the OCR window matches the match string.

Selecting the Read *Mode (continued)*

Choosing the Mode

Here are descriptions of the different mode selections:

- Letters – Select Letters to identify all characters as letters. With Letters selected, the OCR window attempts to identify each character in the window as a letter.

- Numbers – Select Numbers to identify all characters as numbers. With Numbers selected, the OCR window attempts to identify each character in the window as a number.

- Letters/Numbers – Select Letters/Numbers if both numbers and letters will be read in your application, with letters being the first identification choice. With Letters/Numbers selected, the OCR window attempts to identify each character in the window as a letter first. Then, if any characters are not clearly recognized as letters, the OCR window attempts to identify them as numbers. In some cases, numbers might be misread and identified as letters – for example, the number "1" might be identified as the letter "I".

- Numbers/Letters – Select Numbers/Letters if both numbers and letters will be read in your application, with letters being the first identification choice. With Numbers/Letters selected, the OCR window attempts to identify each character in the window as a number first. Then, if any characters are not clearly recognized as numbers, the OCR window attempts to identify them as letters. In some cases, letters might be misread and identified as numbers – for example, the letter "S" might be identified as the number "5".

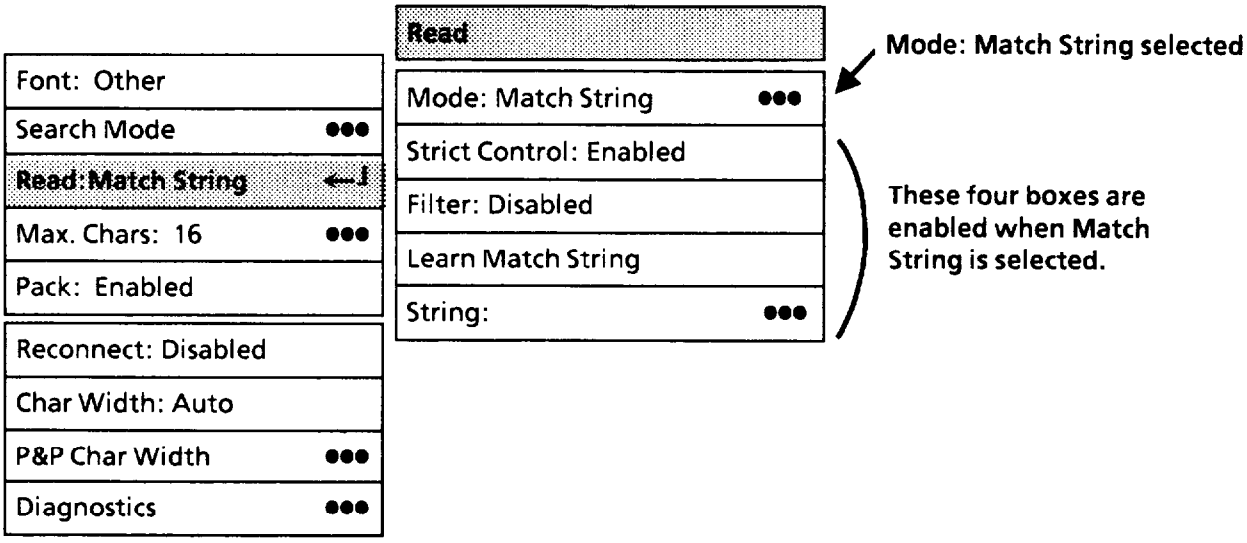
- Match String – Select Match String in order to have the OCR window perform a "match" operation. With Match String selected, you must define the content of the "match string" (see the next section, *Defining the Match String*). During CVIM operation, with Match String selected, the OCR window determines whether each character in the inspected character string matches the corresponding character in the match string.

Note: After selecting the mode, if you have the string window placed over a sample character string, you can use the Learn: box to see what characters the OCR window is identifying (see *Using the Learn Function* in this chapter), in order to check the effect of your mode selection.

Defining the Match String

With Match String selected as the Read: mode, you must define the content of the "match string." The character string you define for the match operation – the "match string" – will appear in the String: box on the Read menu.

Note: With Match String selected, the four other boxes on the Read menu are enabled – that is, the Strict Control, Filter, Learn Match String, and String boxes.

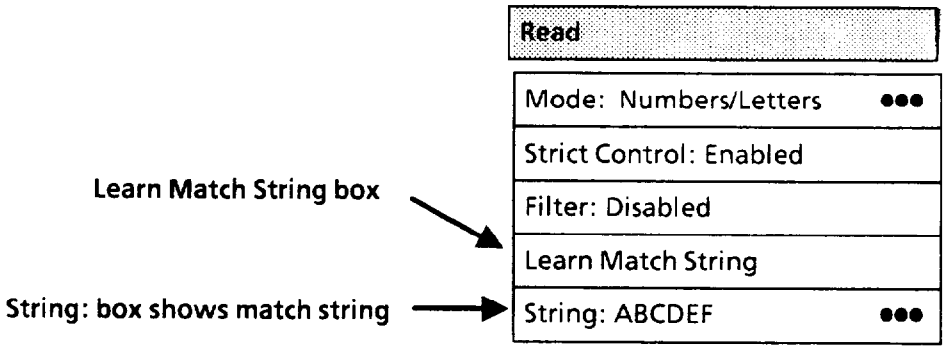


The Learn Match String box and String: box provide two different ways to define the character string (the two methods are discussed in the next two sections).

Using the Learn Match String *Function*

To use the Learn Match String function, you must have first used the Learn: box, so that the desired string appears in the Learn: box. For example, suppose you want to use the character string **A B C D E F** as the match string. If **A B C D E F** currently appears in the Learn: box, do the following:

Your Action	Comments
Pick the Learn Match String *box on the* Read *menu.*	When you pick the Learn Match String box, the **A B C D E F** string in the Learn: box is copied to the String: box. This sets the **A B C D E F** string as the match string.

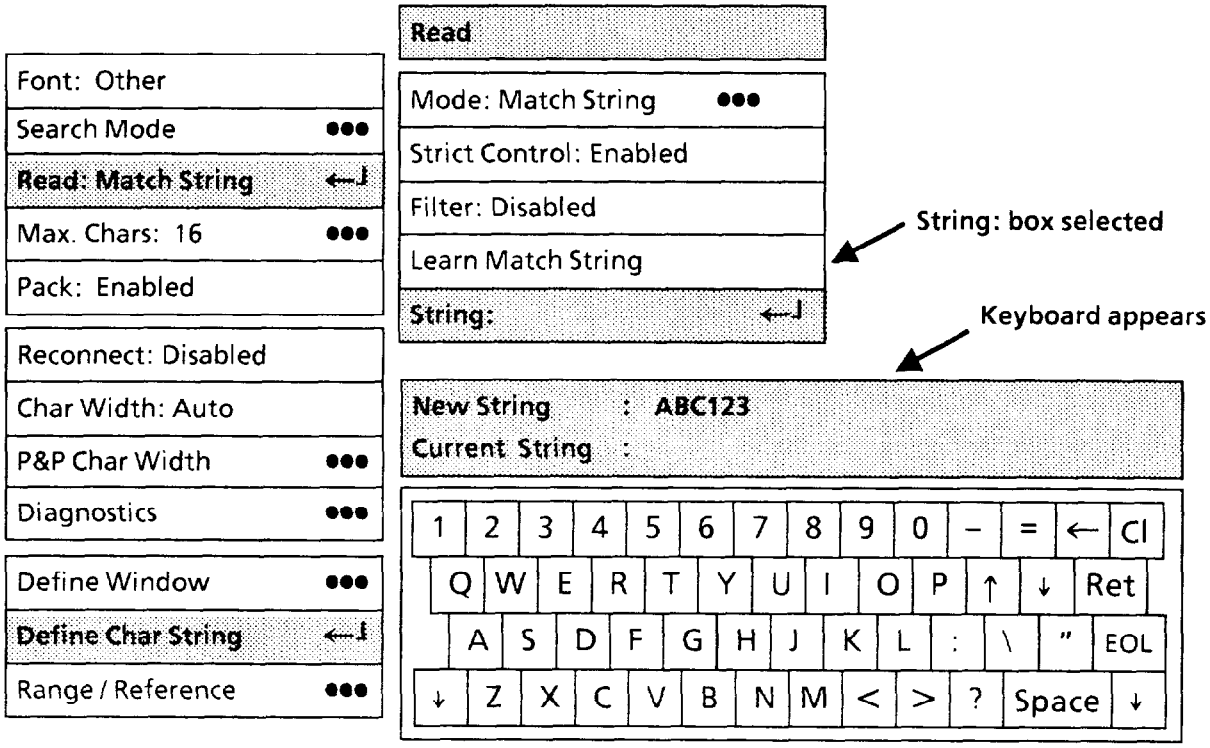


Defining the Match String (continued)

Using the String: *Keyboard*

Instead of using the Learn Match String box, you can enter the match string using the *keyboard*, which appears on the screen when you pick the String: box.

Your Action	Comments
Pick the String: box *on the* Read *menu.*	Picking the String: box displays the keyboard. With the keyboard on the screen, you can select characters from the keyboard with the light pen to define the match string. Note that, above the character boxes, two entry prompts appear on the keyboard. Current String: lists the currently defined match string, if there is one. New String: lists the characters as you select them from the keyboard.


Read
Font: Other
Search Mode
Read: Match String
Max. Chars: 16
Pack: Enabled
Reconnect: Disabled
Char Width: Auto
P&P Char Width
Diagnostics
Define Window
Define Char String
Range / Reference
Mode: Match String
Strict Control: Enabled
Filter: Disabled
Learn Match String
String:
String: box selected
Keyboard appears
New String : ABC123
Current String :
1 2 3 4 5 6 7 8 9 0 - = ← Cl
Q W E R T Y U I O P ↑ ↓ Ret
A S D F G H J K L : \ " EOL
↓ Z X C V B N M < > ? Space ↓

Pick the characters on the keyboard to select the New String: *entry.*	When you pick a character "key" on the keyboard, it appears next to New String: in the keyboard window. For example, to define the string **A B C 1 2 3** as the new string, pick the keys in order, A, B, C, 1, 2, then 3, just as if you were typing. If you pick the wrong character by mistake, pick the "←" key to erase it. To clear the entire entry, pick the "Cl" key.
Pick the Ret *key to enter the new string in the* String: *box.*	When you pick the Ret key, the New String: entry is copied into the String: box, and becomes the match string.

Defining the Match String *(continued)*

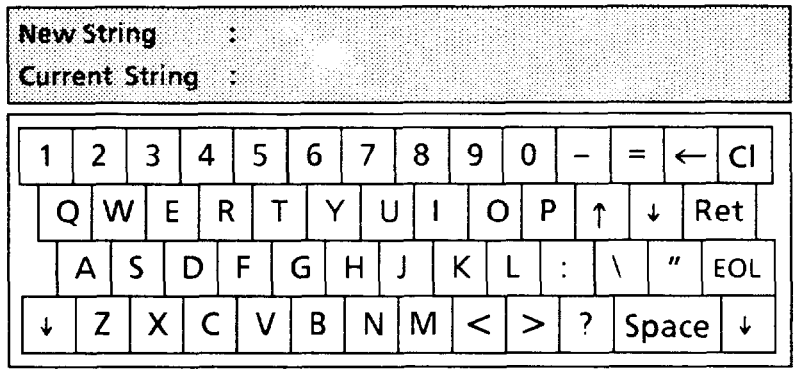
Using the String: *Keyboard*

There is also a "lowercase" keyboard available. This lowercase keyboard includes lowercase characters, and alternate characters, among which are the "wild card" characters.

Note: Remember that the OCR windows do not recognize lowercase alphabet characters.

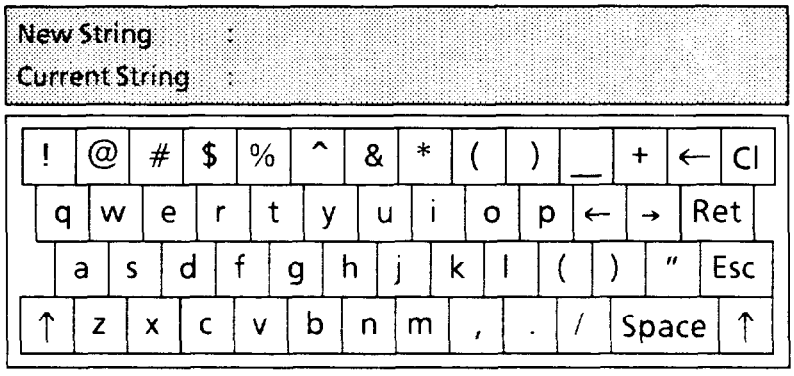
Your Action	Comments
Pick the ↓ key *on the keyboard to access the "lowercase" keyboard.*	Picking either of the two ↓ keys, in the lower left and right corners of the keyboard, displays the lowercase keyboard, as shown below.

Original Keyboard



Picking the ↓ key . . .

. . . changes the keyboard.



"Lowercase" Keyboard

Note that, on the lowercase keyboard, all the *alphabet* characters shift to lower case, and alternate characters appear on the top line, as well as on some of the other keys.

Note also that, on the lowercase keyboard, there are two ↑ keys in the lower left and right corners of the keyboard.

Pick the ↑ key *on the* lowercase *keyboard to access the original keyboard.*	Picking either of the two ↑ keys, in the lower left and right corners of the lowercase keyboard, returns the original or "uppercase" keyboard to the screen.

Defining the Match String (continued)

Valid Characters for the Match String

Some characters on the keyboards are **not valid** for the match operation. Restrict your match string entry to valid characters and/or wild card characters only. If you enter an invalid match string, this message will be displayed:

```
ERROR: Illegal Match String
```

Valid characters are listed below:

- All upper case letters A-Z.
- Digits 0-9.
- The slash (/) character
- Decimal point – either (.) or (, *international*)
  Note: Decimal points are valid only when positioned between *two digits*. Also, only one decimal point is allowed per inspected string.
- Space ( )
  Note: In order to use a space character, you should have *at least three non-space characters* in the match string (an exception is if you manually set the character width, in which case the OCR window could detect spaces with two non-space characters in the string - see "Using Char Width" in Chapter 5). Note that you cannot place two or more "spaces" in a row in a match string. Any spaces you enter must be between other characters and not at the beginning or end of a string. Generally, the inspected space must be as wide as the average width of the inspected characters, or wider. A space detected in the string window is always counted as a single space, even if its width is that of several characters.

Wild Card Characters

The wild card characters allow you to inspect specific characters of a character string for an exact match, while allowing other characters (wherever the "wild card" characters are placed) to vary.

The following characters, all of which are available on the "shift" keyboard, have special usage in the match string:

\# Place this character in the match string to accept any digit from 0-9 as a match.

@ Accept any letter from A-Z as a match.

& Accept any valid character as a match.

* Accept any marking, valid character or not, as a match.

Defining the Match String (continued)

Length of the Match String and the Max. Chars Setting

Make sure the Max. Chars: box is set to a number that is high enough to accommodate the number of characters in your match string (see *Setting Max Chars* for more information).

It is best to set the Max. Chars: box to the exact number of characters in the match string. If the Max. Chars: box is set to a number higher than the number of characters in your match string, and the OCR window detects more characters than are listed in the match string, the inspection fails.

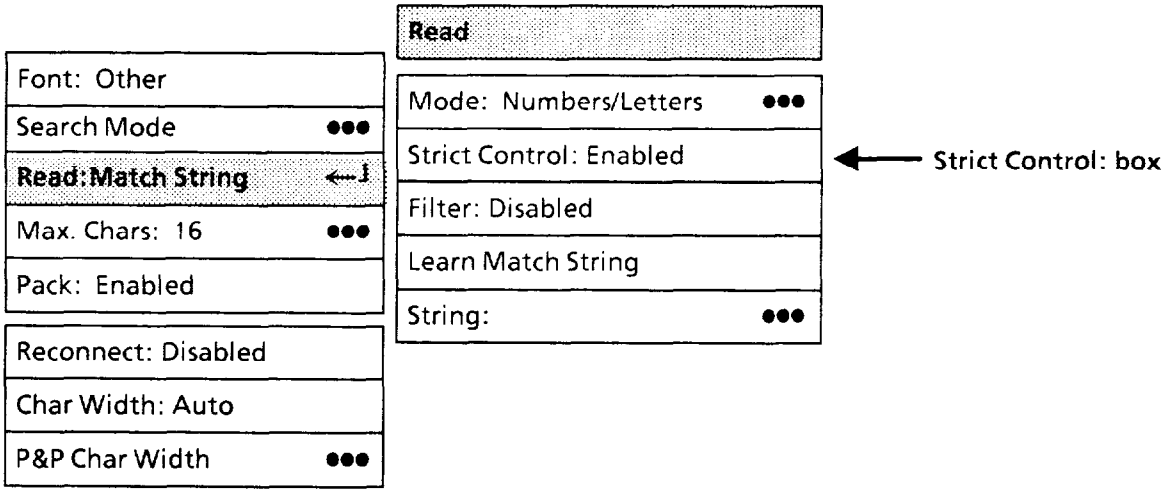
Using the Strict Control Function

The Strict Control: box allows you to select the level of tolerance for character variation when using the OCR windows to verify match strings.

With Strict Control: set to Enabled, the OCR window has a relatively low tolerance level for variations. With Strict Control: set to Disabled, the OCR window has more tolerance for variation; that is, the OCR window is more accepting of character appearance variations.

For example, let's say you are verifying the date **FEB 92**. Suppose that because of variance in print quality, sometimes the **B** in **FEB** is misread as an **8**, causing the inspection to fail. In this case, if you want to make the OCR window more tolerant of variance, you would set the Strict Control: box to Disabled. This would set a higher tolerance for variation, allowing **B** characters of lesser quality to be accepted, so inspections do not fail due to the **B** characters.

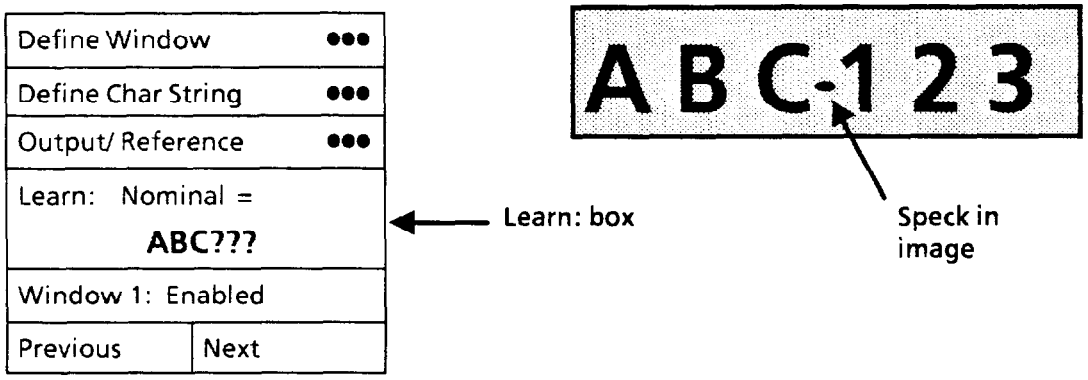
Your Action	Comments
Pick the Strict Control: *box box on the* Read *menu.*	When you pick the Strict Control: box, the setting toggles between Enabled and Disabled. Enable or disable according to your application requirements.



Using the Filter *Function*

The Filter: box allows you to enable or disable the *filter* function. With the Filter function enabled, the OCR window ignores small specks in the OCR window image. These specks might be errant ink specks, or dirt, for example, which would normally cause a match operation to fail.

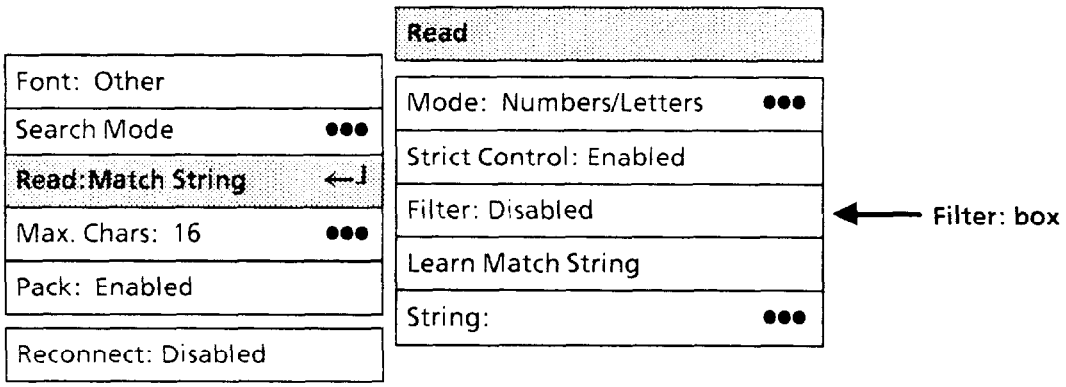
For example, let's say you are verifying the string **ABC123**. Suppose that because of variance in printing quality, occasionally specks of ink appear with the inspected string, causing the match operation to fail:



In this case, if you want to allow the OCR window to accept the appearance of small specks, you would set the Filter: box to Enabled, so that inspections are accepted with the specks.

Note: If a speck in the image touches a character or characters in the OCR window, the speck is not ignored. In this case, if the speck sufficiently alters a character's appearance, the character will not be recognized, and the match operation will fail. Also, a speck may connect characters, causing the OCR operation to fail. In this case, the Char Width function would be useful (see "Using Char Width" in Chapter 5).

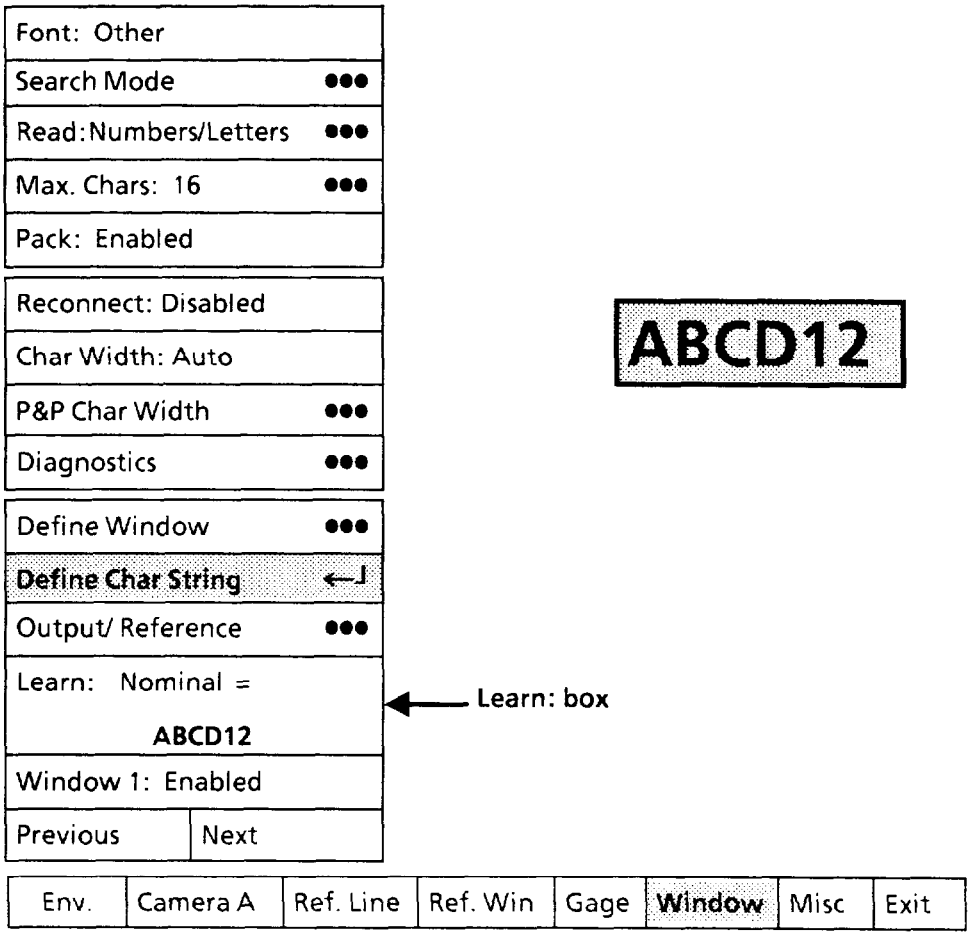
Your Action	Comments
Pick the Filter: *box box on the* Read *menu.*	When you pick the Filter: box, the setting toggles between Enabled and Disabled. Enable or disable according to your application requirements.



Using the Learn: *Function*

You can use the Learn: box to display the results of the OCR window inspection during set-up, as with other windows. In the case of OCR windows, picking the Learn: box displays characters as recognized by the OCR window.

Pick the Learn: box after you have configured an OCR window to get feedback which can help you determine whether the window, as configured, provides the desired inspection results, or whether adjustments to configuration, staging, etc., are necessary.



When you pick the Learn: box:

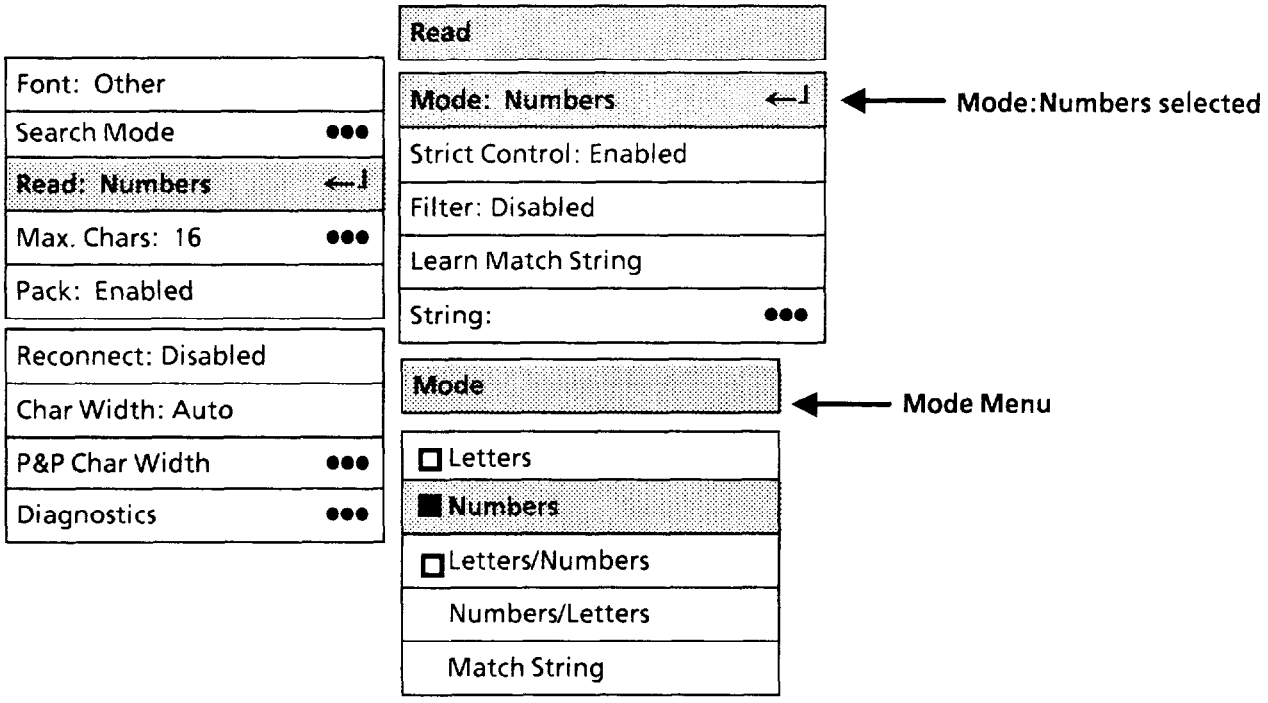
- Characters are displayed as recognized.
- The "?" is displayed for each character not recognized.
- The number 0 (zero) is displayed in the Learn: box with a slash through it to distinguish it from the letter O.

Using the Learn: *Function (continued)*

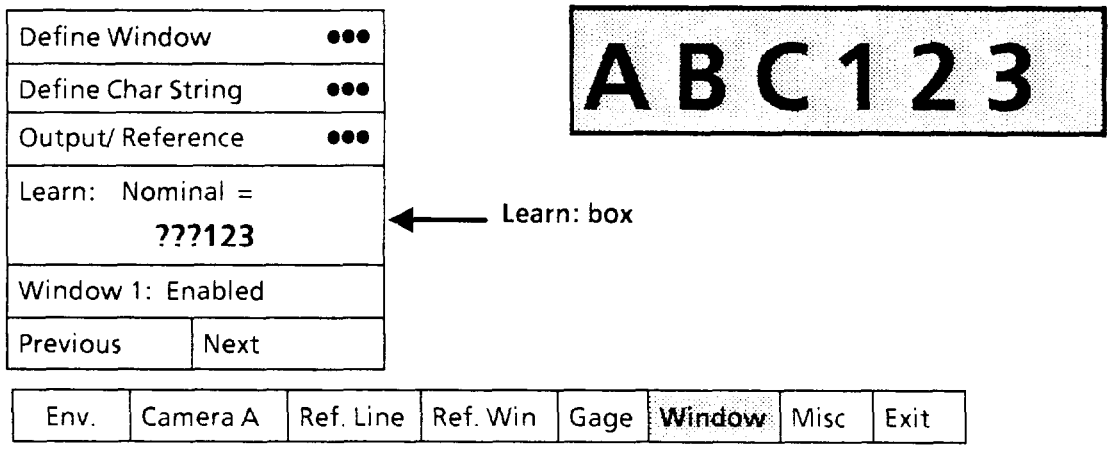
Examples of Using the Learn: *Function*

The following examples assume the OCR settings such as Font: and Search Mode: have already been set according to the requirements of the application.

Example #1: Mode: Numbers – Assume you have placed the OCR window over the characters **A B C 1 2 3**, and set the Mode: box on the Match Mode: menu to Numbers.



Your Action	Comments
Pick the Learn: *box on the* Window *menu*	Picking the Learn: box causes the character string to appear in the Learn: box. In this case, **? ? ? 1 2 3** appears in the Learn: box. The three **?** characters indicate that **A**, **B** and **C** are not recognized. Recall that in Numbers mode the OCR window tries to identify each character as a number only, and does not recognize letters.

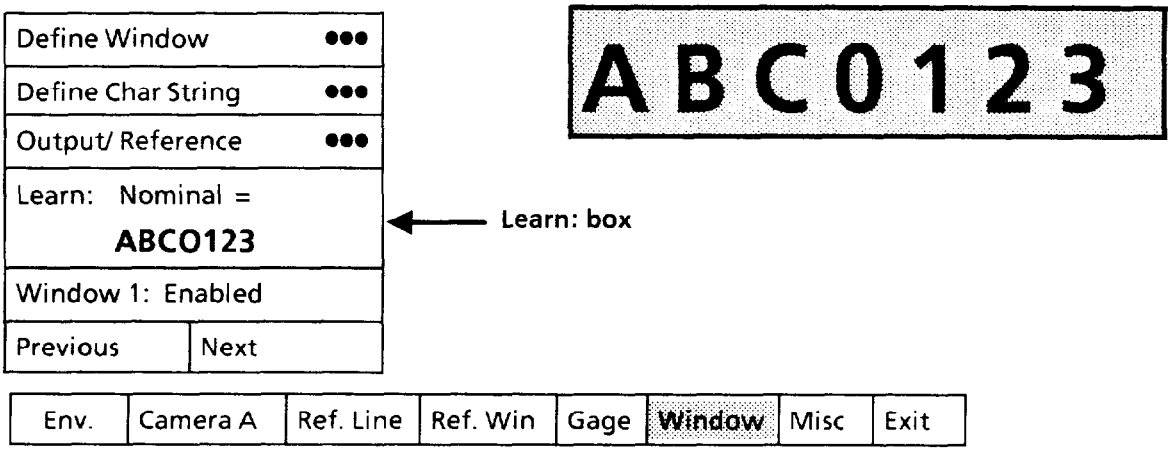


Using the Learn: *Function (continued)*

Examples of Using the Learn: *Function*

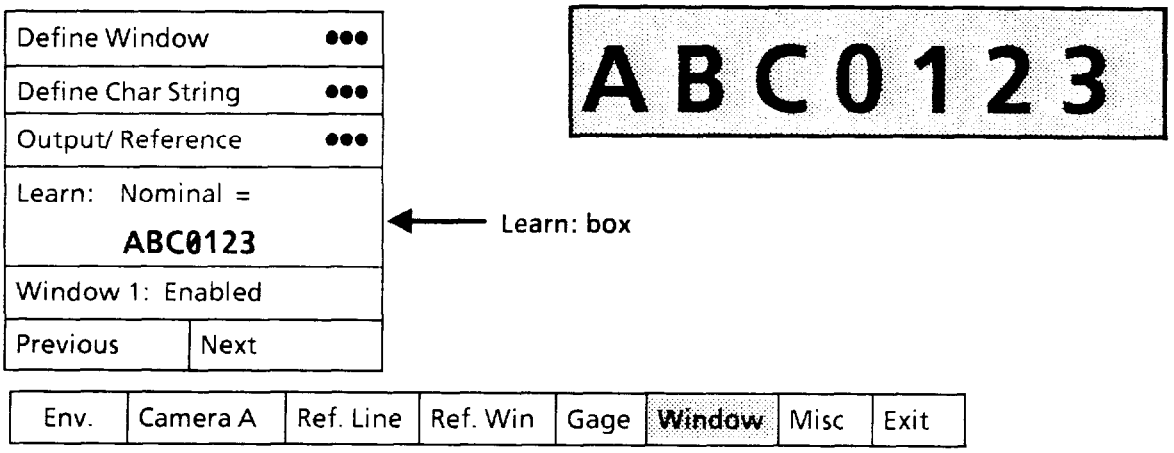
Example #2: Mode: Letters/Numbers – Assume now you have set the Mode: box to Letters/Numbers.

Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the character string to appear in the Learn: box. In this case, **A B C O 1 2 3** appears in the Learn: box. Note that the fourth character is identified as the letter O, and not 0 (zero). Recall that in Letters/Numbers mode the OCR window attempts to identify each character as a letter first.



Example #3: Mode: Numbers/Letters – Assume now you have set the Mode: box to Numbers/Letters.

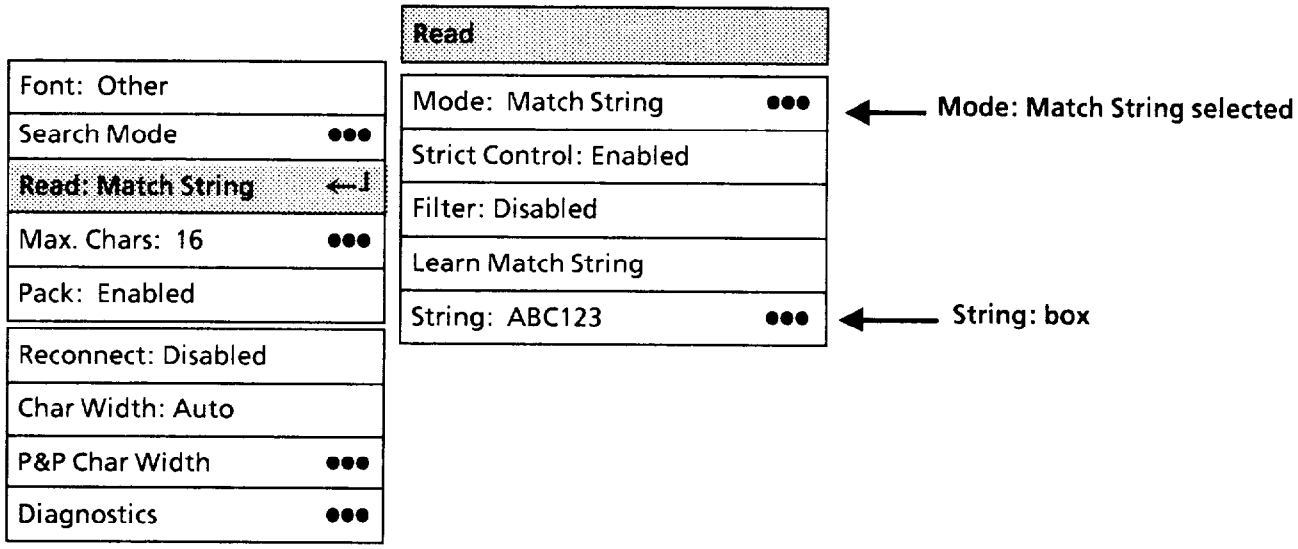
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the character string to appear in the Learn: box. In this case, **A B C 0 1 2 3** appears in the Learn: box. Note that the fourth character is identified as 0 (zero), and not the letter O. Recall that in Numbers/Letters mode the OCR window attempts to identify each character as a number first.



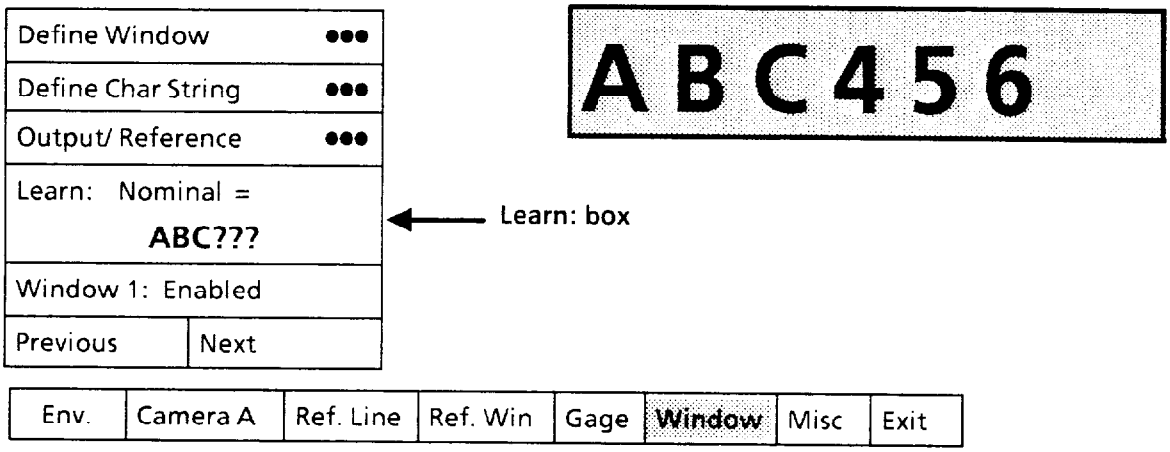
Using the Learn: *Function (continued)*

Examples of Using the Learn: *Function*

Example #4: Mode:Match String – Assume now you have set the Mode: box to Match String, and you have set the String: box to **A B C 1 2 3**. Assume you are now inspecting the character string **A B C 4 5 6**.



Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B C ? ? ?** to appear in the Learn: box. Recall that in Match String mode, the OCR window checks to see if the inspected string matches the match string. In this case, the last three inspected numbers, **4 5 6**, do not match the last three numbers in the match string, **1 2 3**, so the three question mark characters (**? ? ?**) appear. Wherever the **?** character appears in the Learn: box, there is no match.

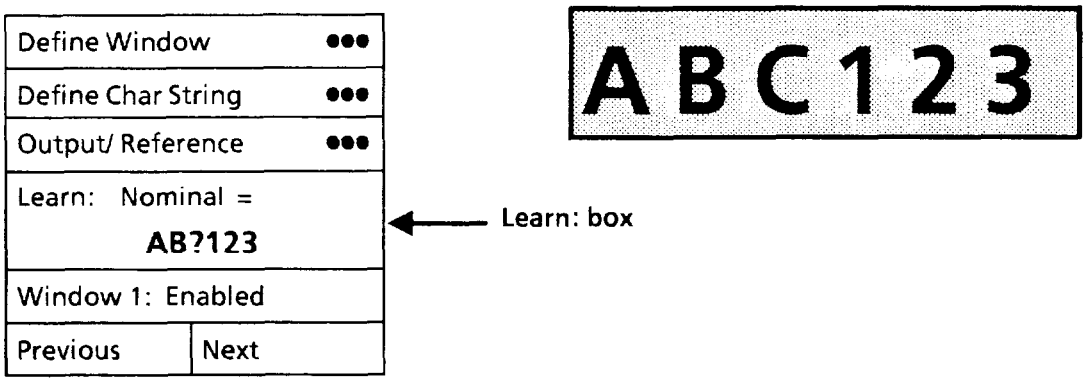


Using the Learn: *Function (continued)*

Examples of Using the Learn: *Function*

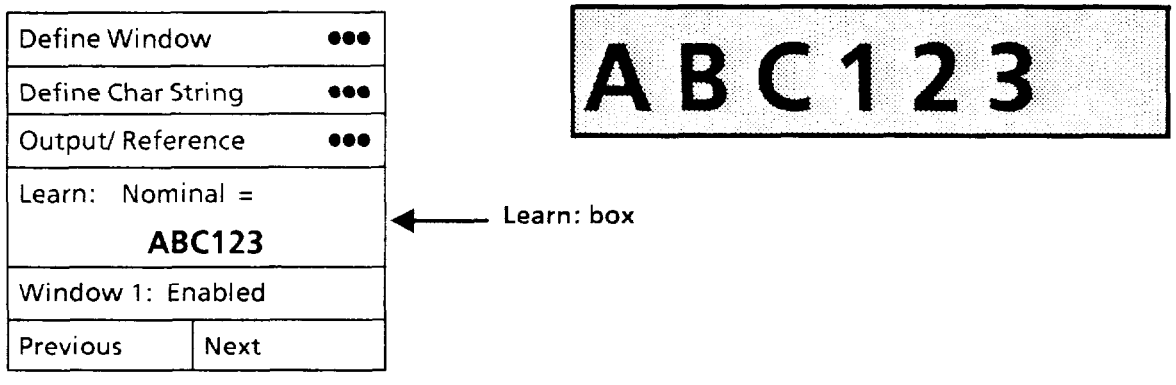
Example #5: Mode:Match String – Assume now you have set the String: box to **@ B # 1 2 3**. Recall that the @ character regards any letter as a match, while the # character regards any number as a match.

Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B ? 1 2 3** to appear in the Learn: box. In this case, the first character in the inspected string, **A**, is recognized as a letter; the @ character regards letters as a match, so the **A** appears in the Learn: box. The third character in the inspected string, **C**, is not a number, and since the # regards only numbers as a match, the question mark character (**?**) appears.



Example #6: Mode:Match String – Assume now you have set the String: box to **& B C 1 2 &**. Recall that the & character regards any valid character as a match.

Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B C 1 2 3** to appear in the Learn: box. In this case, the first character in the inspected string, **A**, is recognized as a letter; so the **A** appears in the Learn: box. The last character in the inspected string, **3**, is recognized as a number, so the **3** appears in the Learn: box.

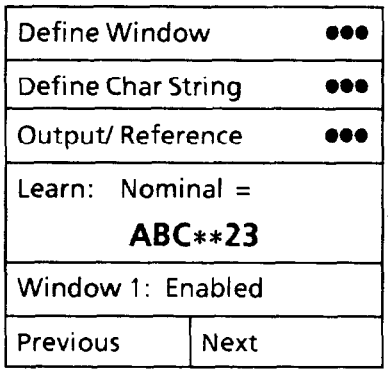


Using the Learn: *Function* *(continued)*

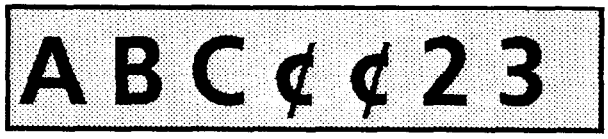
Examples of Using the Learn: *Function*

Example #7: Mode:Match String – Assume now you have set the String: box to **A B C * * 2 3**. Recall that the * character regards any detected marking as a match, whether it is a valid character or not.

Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B C * * 2 3** to appear in the Learn: box. In this case, the ¢ characters in the inspected string are detected; this is indicated by the two * characters in the Learn: box (when you place the * character in the String: box, the OCR window does not try to identify the character; it merely checks for a marking).

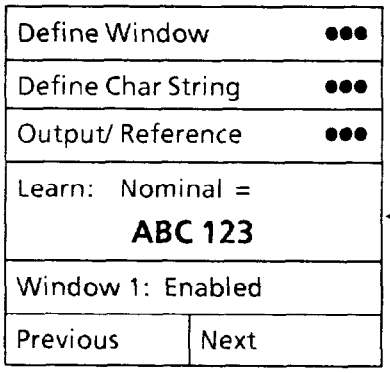


Learn: box

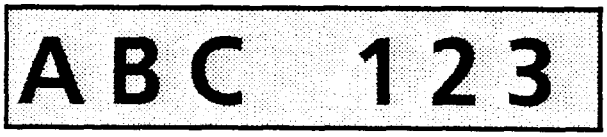


Example #8: Mode:Match String – Assume now you have set the String: box to **A B C 1 2 3** (with a "space" between the **C** and the **1**).

Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B C 1 2 3** to appear in the Learn: box (with a "space" between the **C** and the **1**). In this case, the "space" character in the inspected string is detected; this is indicated by the space present in the string in the Learn: box. Had the "space" not been detected, the Learn: box would have read **A B C ? ? ? ?**.



Learn: box



Setting Max. Chars

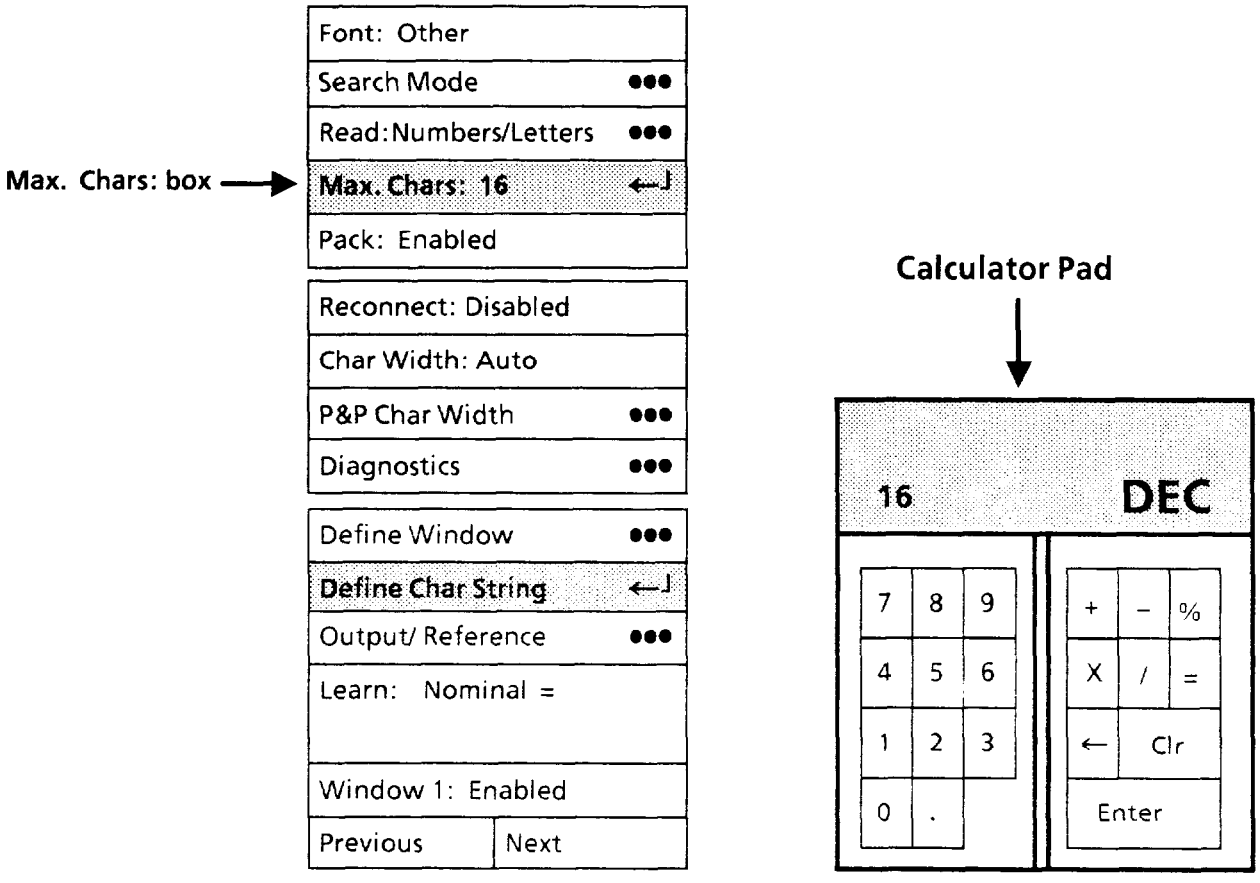
The Max. Chars function enables you to select the *maximum number of characters* your string window will inspect. The CVIM inspects only up to the selected maximum number of characters, regardless of the number of characters which may appear in the string window.

The Max Chars: setting is limited to the following range:

- The highest Max. Chars number you can set is 16 (provided enough character windows can be allocated).
- The lowest Max. Chars number you can set is 1.

Set the Max Char: box number to the maximum number of characters you expect to inspect with your string window.

Your Action	Comments
Pick the Max. Chars: *box on the* Define Char String *menu.*	When you pick the Max. Chars: box, the calculator pad appears on the monitor screen.



Pick the digits on the calculator pad to select the Max Chars *entry.*	When you pick a digit on the calculator pad, it appears in the "window" of the pad. For example, to select "10," pick "1," then pick "0."

If you make a mistake, pick the "←" key. To clear the entire entry, pick the "Clr" box on the calculator pad.

Setting Max. Chars *(continued)*

Your Action

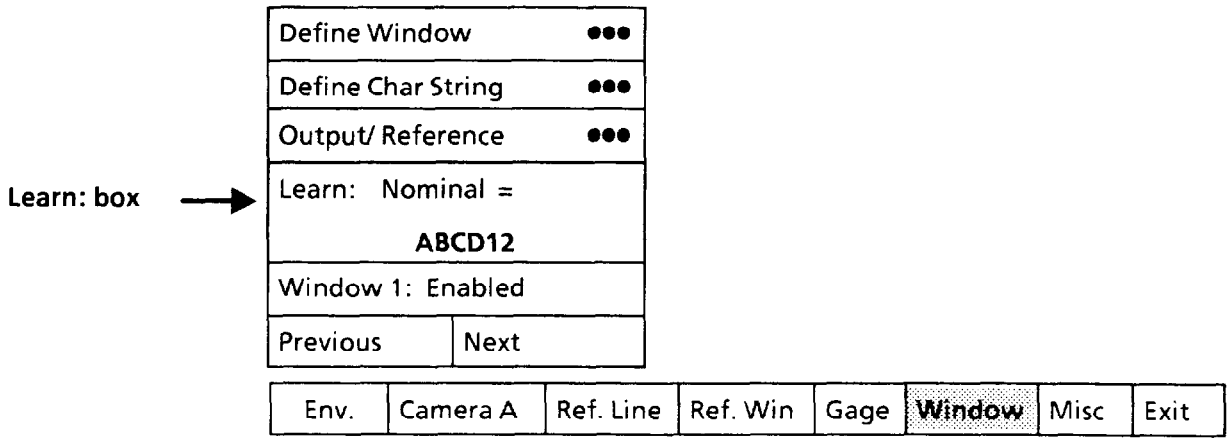
Pick the Enter *box on the calculator pad.*

Once you have selected the desired number, picking the Enter box puts the number in the Max. Chars: box.

> **Note:** The CVIM must be able to allocate enough character windows to inspect the maximum number of characters. If you select a number beyond the range (1-16), or if there are not enough windows available for character windows for the maximum number entered, the message – **Value Out of Range** – flashes on the calculator pad, and you will not be allowed to enter the number.

Pick the Learn: *box after changing the* Max. Chars: *box setting.*

When you pick the Learn: box after changing the: Max. Chars: box setting, the CVIM updates the character windows according to the Max. Chars setting, and also according to the Pack setting (see the next section).



Effect of the End Chars *Setting*

As discussed earlier, the string window will inspect only the number of characters as set in the Max. Chars box. For example, suppose you inspect this string with 8 characters:

A B C D 1 2 3 4

Now suppose the Max Chars: box is set to 6. Normally, with the End Chars box *disabled*, the OCR window will inspect only the first 6 characters:

A B C D 1 2

If the End Chars box is *enabled*, however, the OCR window will inspect only the last 6 characters in the string:

C D 1 2 3 4

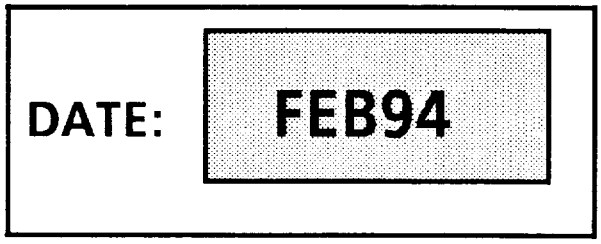
Setting Max. Chars *(continued)*

Effect of the End Chars ***Setting*** *(continued)*

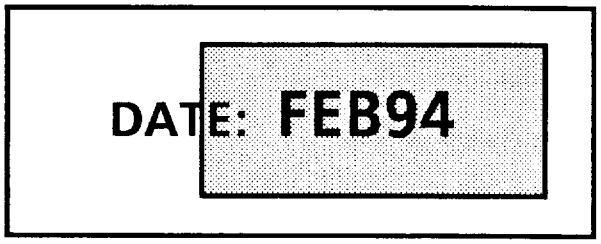
Note: See "The End Chars Function" for information on enabling and disabling the End Chars function.

The benefit of enabling the End Chars function is that it enables the OCR window to ignore unwanted characters or other objects, such as logos, which may appear with the target characters in the OCR window during inspections.

For example, suppose you want to inspect the printed date on labels which follows the word "**DATE**":

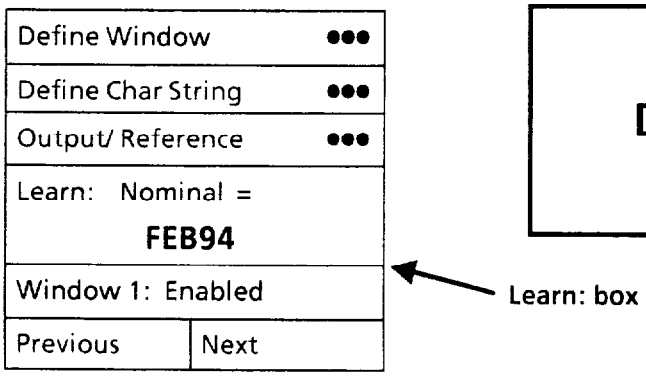


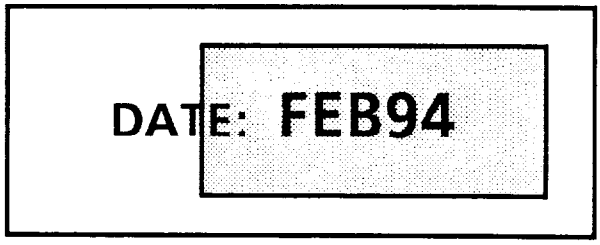
The problem is, you do not want to inspect the word "**DATE**," but the word, or part of it, sometimes appears in the OCR window due to printing or positioning inconsistencies:



One way to avoid inspecting the word "**DATE**," and still inspect the actual date, would be to set Max Chars to 5, and set End Chars to Enabled.

For example, if, during setup, you were to pick the Learn: box, with End Chars set to Enabled, and Max Chars set to 5, the OCR window would inspect only the last 5 characters in the OCR window as shown below:





Setting the Pack Function

The Pack: box allows you to *enable* or *disable* the character "packing" function. Character packing works like this:

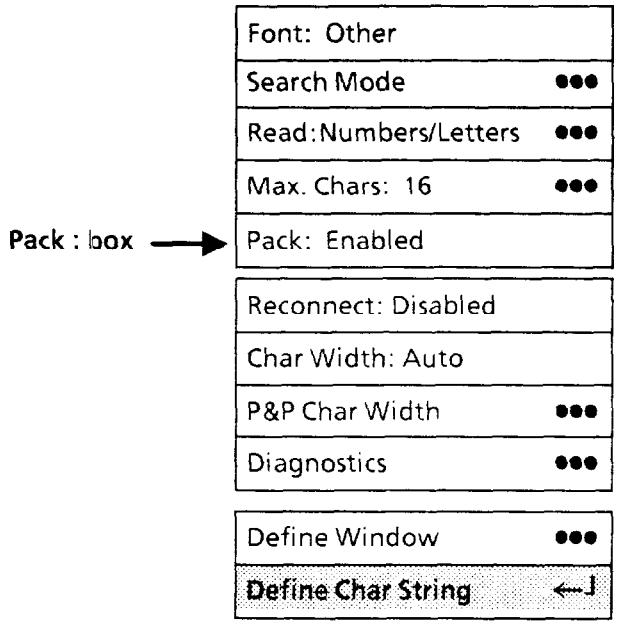
- With Pack *disabled*, the CVIM allocates one character window for each character being inspected in the string window. The number of character windows allocated with Pack: *disabled* is equal to the number shown in the Max. Chars: box.

  The advantage of setting Pack to *disabled* is this: With Pack: *disabled*, there is one character window for each character; this means you can set the threshold for each individual character inspected. This is desirable if the lighting intensity varies from character to character, as may be the case if you are inspecting characters on a round object.

- With Pack *enabled*, the CVIM allocates one character window for each group of up to four characters in the string window to be inspected.

  The advantage of setting Pack to *enabled* is that you will use less windows than if Pack is *disabled* (unless you are inspecting a single character). With Pack *enabled*, you can set the thresholds for the groups of characters in the individual character windows.

Your Action	Comments
Pick the Pack: *box* to enable or disable packing.	When you pick the Pack: box, the setting toggles between Enabled and Disabled.



Setting the Pack *Function (continued)*

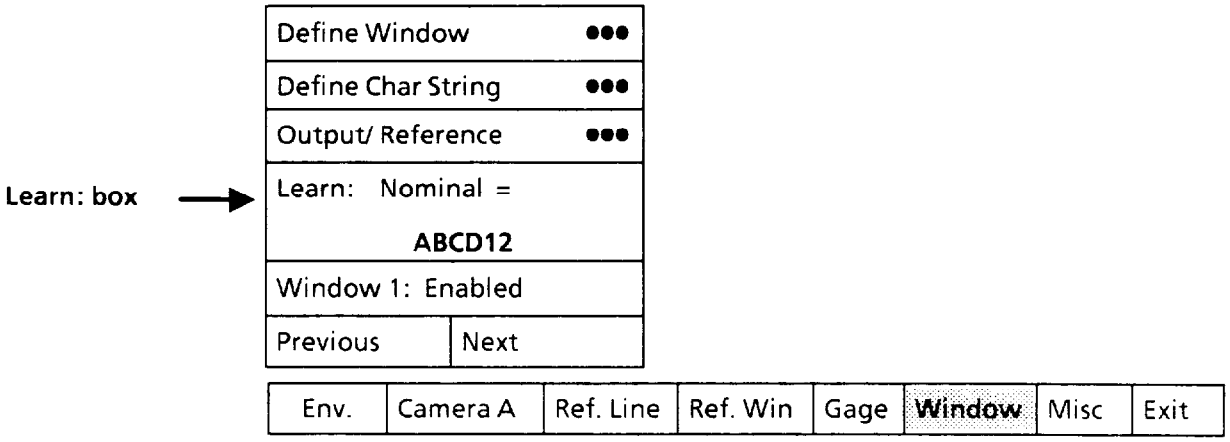
Note: If you set Pack to Disabled, and there are not enough windows available for character window allocations, this message appears on the screen:

> **ERROR: There are not enough character windows available to unpack the characters.**

If this message appears, you cannot disable the Pack function. You must either leave the Pack: box set to Enabled, or arrange your window selections so that enough windows are available.

After changing the Pack: box setting, if you pick the Learn: box, the CVIM updates the character windows as according to the Pack: box (and Max. Char. box) setting. **Note:** It is not mandatory that you pick the Learn: box after changing the Pack: box setting; if you do not, the new setting will take effect during run mode anyway, but the new window allocation will not be observable during setup.

Your Action	Comments
Pick the Learn: *box after changing the* Pack: *setting.*	



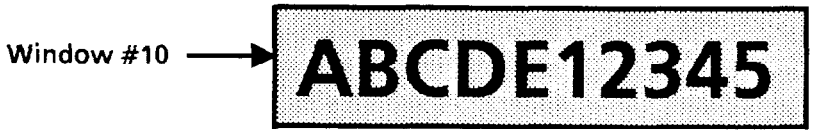
Setting the Pack *Function (continued)*

Examples of setting the Pack ***and*** Max. Chars ***boxes:***
The following examples illustrate the setting of the Pack: and Max. Chars: boxes:

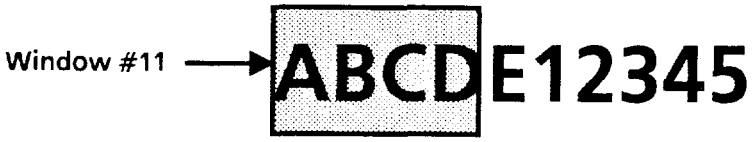
Example 1 – Pack: Enabled: Recall that with Pack *enabled*, the CVIM will allocate one character window for each group of four characters. For example, if there are 10 characters in the string window, the CVIM will allocate one character window for the first four characters, one for the second four characters, and one for the last two characters, for a total of three character windows.

Consider the following scenario: You have enabled window #10, and selected *OCR* as the operation. Windows 11-24 are all available for character windows; that is, they are all *disabled*, and none of them are set for *OCR* operation.

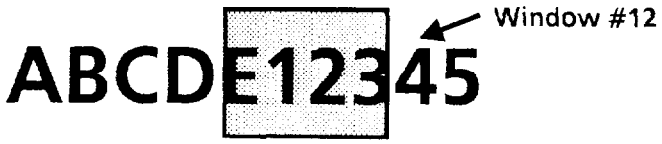
You have placed the window #10, which is the *string* window, over the horizontal character string which consists of 10 characters, ABCDE12345, as shown below:



You have set Max. Chars to 10, and Pack to Enabled. If you pick the Learn: box, then pick the Next box, you will see that:



window #11 is *enabled*, and is placed over the first four characters.



If you pick Next again, you will see that Window #12 is *enabled*, and is placed over the next four characters.

If you pick Next again, you will see that Window #13 is *enabled*, and is placed over the last 2 characters.

Setting the Pack *Function (continued)*

Example 2 – Pack: Disabled: Recall that with Pack *disabled*, the CVIM will assign one character window to each character.

Now consider this scenario: You select Window #10 again. You leave Max. Chars set to 10, and change Pack to *disabled*. Then you pick the Learn: box to update the character windows.

If you then pick the Next box, you will see that:

window #11 is enabled and placed over the first character.

If you pick the Next box again, you will see that window #12 is enabled and placed over the second character;

If you pick the Next box again, you will see that window #13 is enabled and placed over the third character; and so on through window #20. Each of the 10 characters is now assigned a character window.

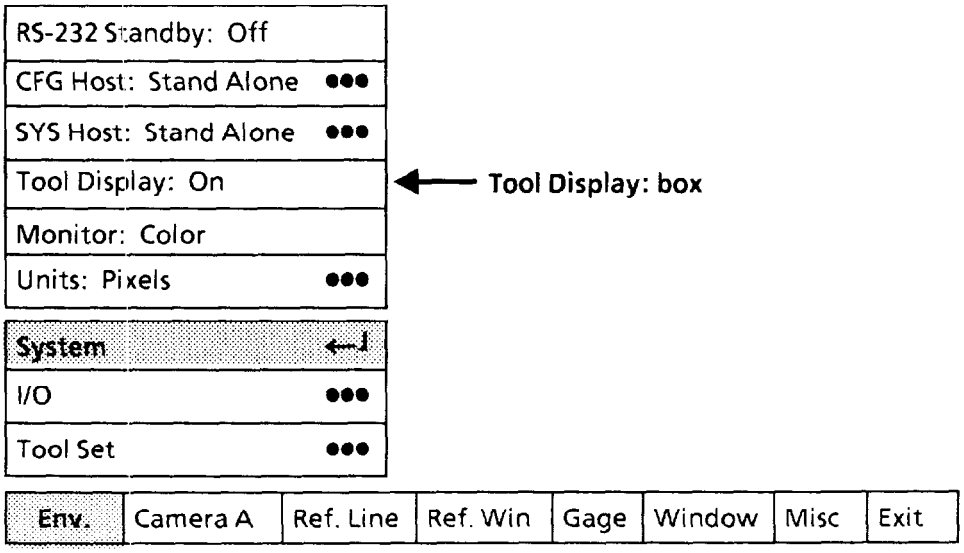
Now suppose you set the Max. Chars: box to 8, then pick the Learn: box. If you then pick the Next box repeatedly, you will see that window #11 has automatically been placed over the first character; window #12 has been placed over the second character, and so on through window #18. However, since Max Chars is set to 8, no windows are placed over the last two characters (4 and 5).

Now suppose you set the Max. Chars: box to 12, then pick the Learn: box. If you then pick the Next box repeatedly, you will see that windows 11–20 have all been *enabled*, and that character windows have been placed over all 10 characters. You will see that windows 21 and 22 have been allocated, but are *disabled* (the Window#: box for each reads Disabled in dark letters). Windows 21 and 22 are automatically *enabled* and used for character windows, if and when 12 characters appear in the string window.

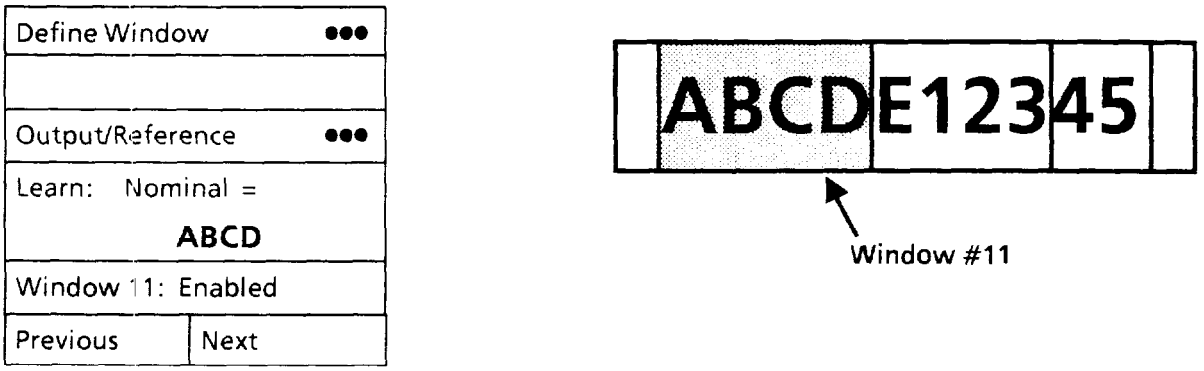
Setting the Pack *Function (continued)*

Note on Tool Display:
You can configure the CVIM with the Tool Display set to On so that all the enabled tools are visible during setup. For OCR windows, this means that the search window (if used), string windows, and the associated character windows are visible at the same time. To set the Tools Display to On:

Your Action	Comments
Pick the Env. *box on the* Main *menu.*	When you pick the Env. box, the *Environment* menu appears.
Pick the System *box on the* Env. *menu.*	When you pick the System box, the *System* menu appears.
Pick the Tool Display *box on the* System *menu.*	When you pick the Tool Display box, the box toggles between On and Off.



For example, in the diagram shown below, window 11, a character window associated with string window #10, is selected. With Tools Display set to On, window #11 is highlighted, while the associated string window and the other character windows are outlined:



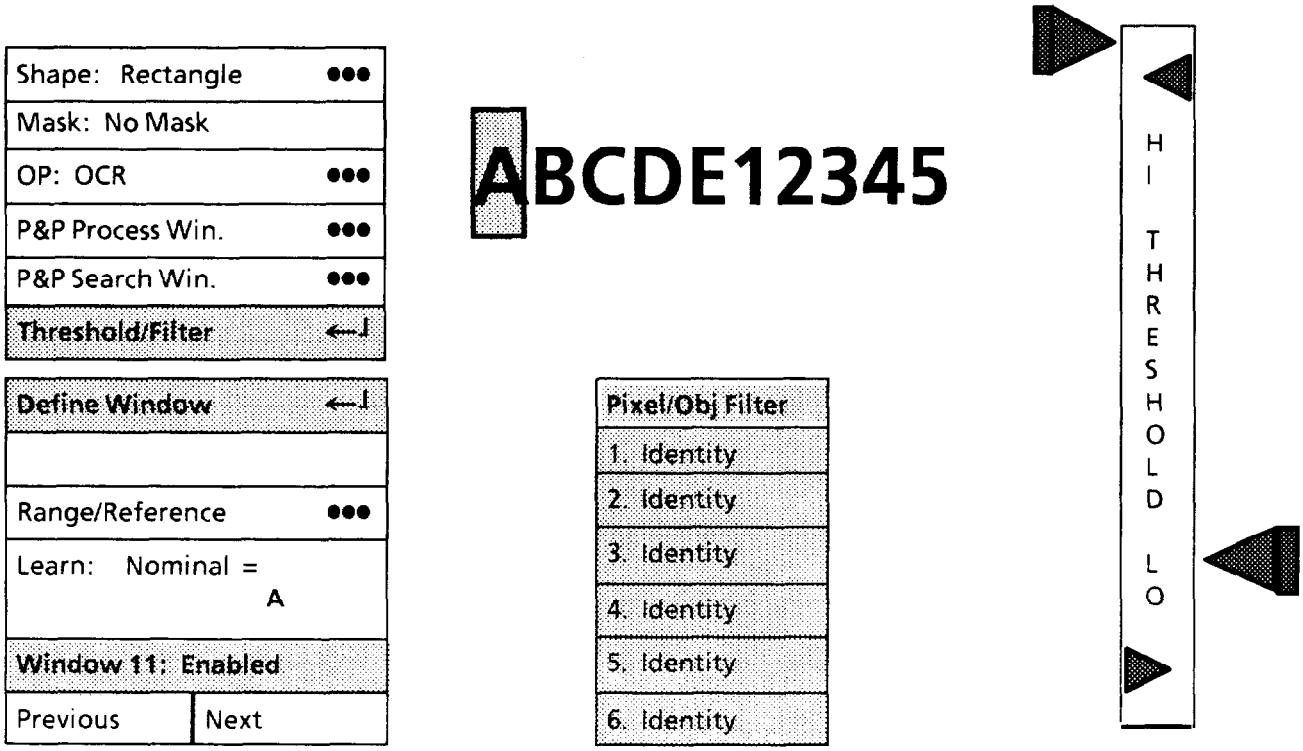
Setting the Pack Function (continued)

Adjusting Character Window Thresholds

Recall that when you set the threshold for the *string* window, you are also setting the threshold for all the associated *character* windows. The OCR-PAK option allows you to set the threshold of individual character windows as well.

Note that, with Pack set to Disabled, so that a character window is assigned to each character, you can adjust the threshold for *specific individual characters* in the inspected string (as shown below). This is useful, for example, when the lighting varies from character to character, such as might happen when inspecting characters on a round bottle.

To adjust the threshold of a specific character window, you simply select the character window you want to adjust (using the Next or Previous box), then follow the same procedure described for the string window (see *Adjusting the Threshold* in this chapter).



Note: After you set the threshold level of a *character* window, its setting will revert back to the *string* window's threshold setting, if you:

- Enable or disable the Pack function.
- Adjust the threshold level of the string window.
- Select the P&P Process Win. box.

Using the Search Window

This section discusses the search window function of the OCR-PAK option. This section begins with some questions and answers in order to introduce the search window.

What is the search window?
The *search window* is a type of shift compensation tool that is available for use exclusively with OCR windows. Recall that the CVIM has other shift compensation tools – the reference lines and reference windows (see the *CVIM User's Manual* for more information about these tools).

What is shift compensation?
In some applications, the features to be inspected by a line gage or window may shift position in the image from inspection to inspection. To account for this position shift, you use the shift compensation tools of the CVIM to detect the amount and direction of shift, and apply the same shifting to the inspection tool as the shift of the features.

How does the search window work?
During setup, the search window "learns" the positions of features contained within its borders. During an inspection, the search window inspects the area within its borders for feature content. If, during an inspection, the content in the search window shifts from the "learned" position, the search window shifts the OCR string window the same amount and direction as the content shift.

Can you use reference lines and reference windows with OCR windows?
You can effectively use reference lines and reference windows with OCR windows, if the character string you are inspecting is *consistently aligned* with an edge or feature in the inspected image. However, in many applications, the character string position is not consistently aligned with a feature or edge in the image.

Note: You **cannot apply rotation compensation** to an OCR window; you can only compensate for horizontal and/or vertical shifting.

When should you use the search window?
You should use the search window as the shift compensation tool of first choice when shift compensation is required for your OCR application, since the search window does not require that the character string be consistently aligned with an edge or feature in the image.

Using the Search Window (continued)

Can you use both a reference tool and a search window with an OCR window?

You can use the search window to provide shift compensation along with a reference tool's shift compensation. Note that if you also assign a reference tool to the OCR window and you also use the search window, the reference tool shift compensation is applied to the search window. If you use the reference tool and no search window, shift compensation from the reference tool is applied directly to the OCR string window.

How do you set up the search window?

You first enable the search window for the OCR window you are configuring. Then you place the search window over the desired area on the monitor screen, using the "pick & place" function, much like any other window. You then pick the Learn: box, and the search window "learns" the positions of features detected within its borders (it ignores anything that touches or crosses its borders).

How do you place the search window?

Generally, you should remember these points when "picking & placing" the search window:

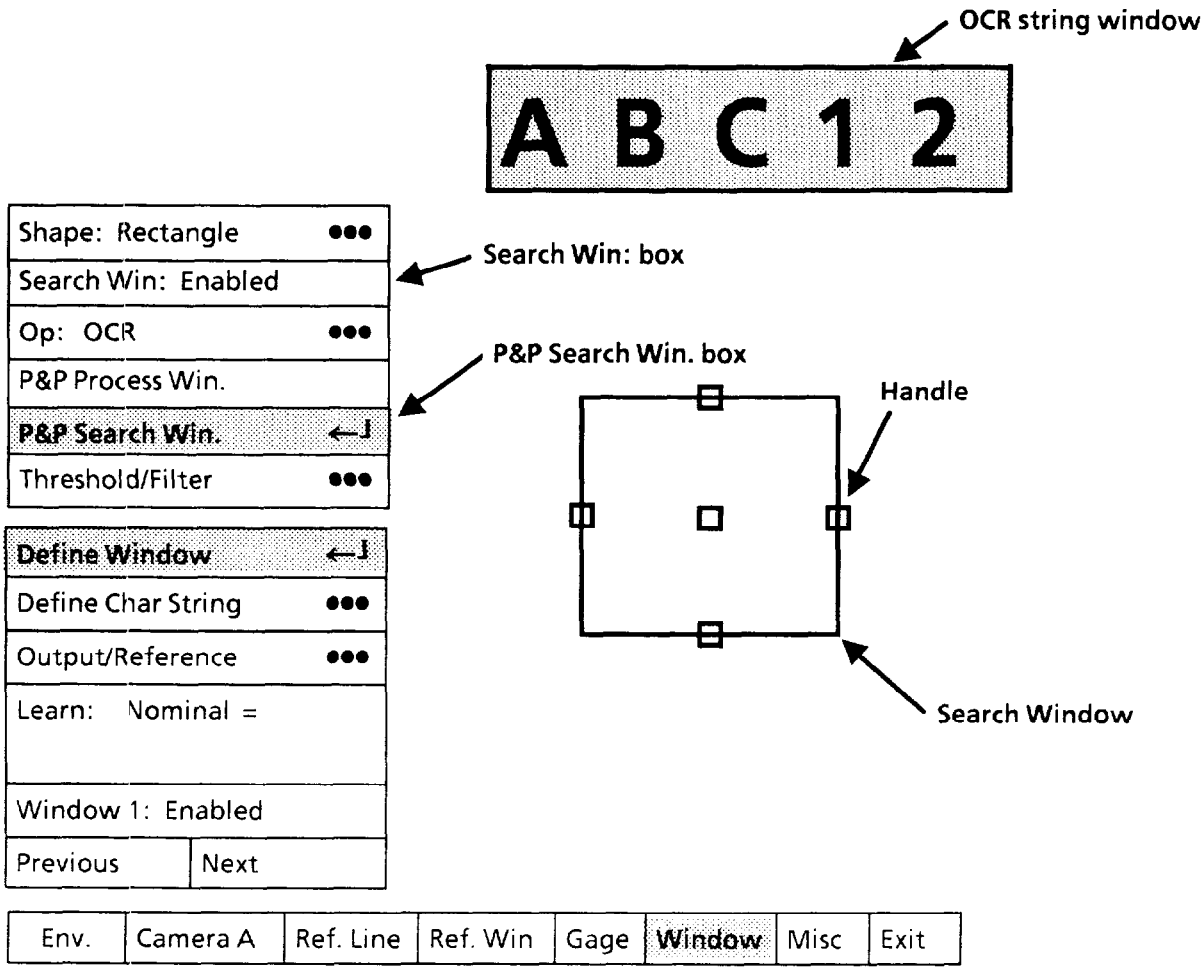
- The search window analyzes every item within its border for shift. Therefore, it is best to include in the search window only the features that shift in the same amount and direction as the inspected character string. This may mean that you only include the character string itself in the search window. The rest of the search window area should be blank, both during setup, and during operation.

- The search window does not regard any feature which touches its border as being in the search window. When placing the search window during setup, then, you can allow the search window to overlap features that do not shift, so long as they are touching the borders. This also means that if any feature that is fully in the search window during setup touches the border during operation, that feature will be ignored by the search window. This may cause a shift compensation to be applied that is not directly in accordance with the actual feature shift. This could cause the window inspection to fail.

Using the Search Window *(continued)*

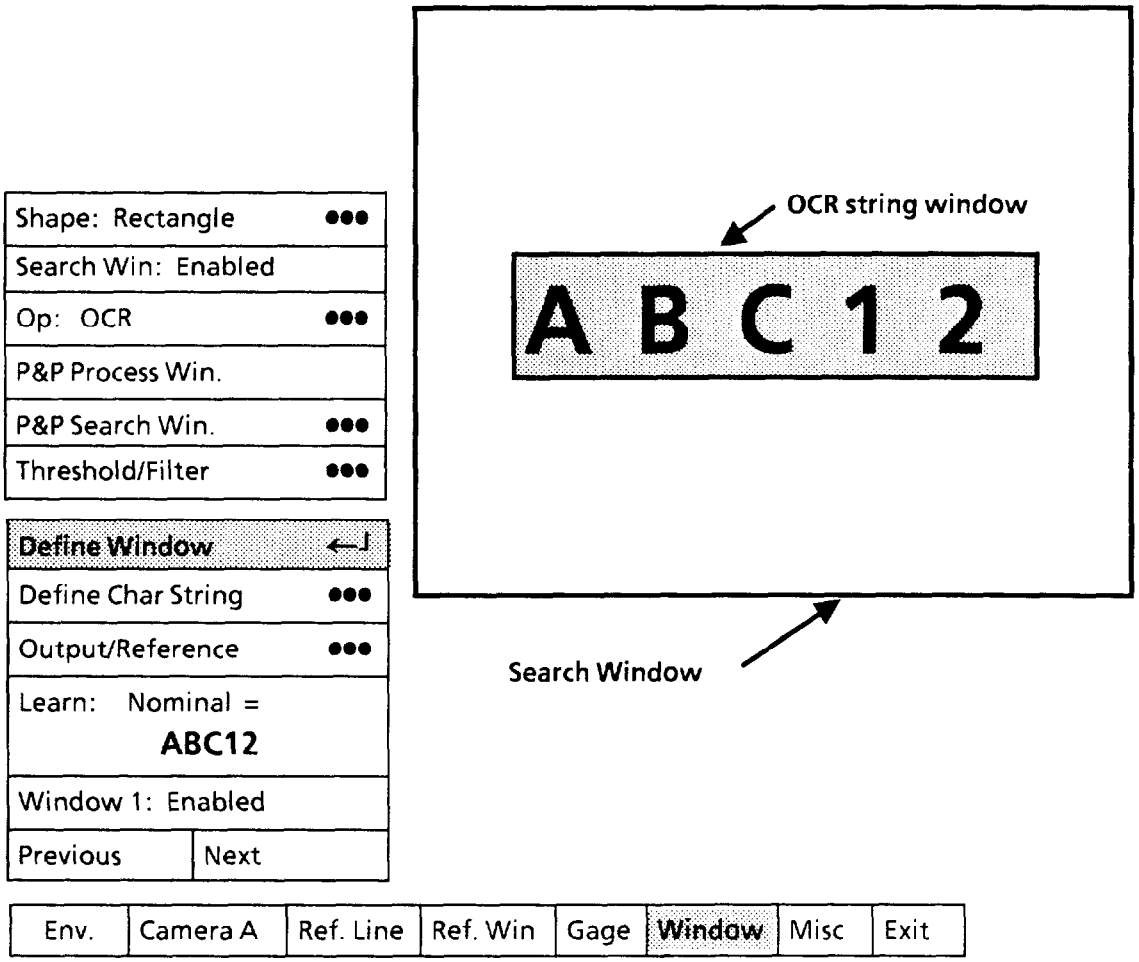
Use the following steps to enable and place the search window (these steps assume the Op: box is already set to OCR on the Define Window menu).

Your Action	Comments
Pick the Define Window *box on the* Window *menu to access the* Define Window *menu.*	Picking the Define Window box displays the Define Window menu.
Pick the Search Win: *box to enable the search window.*	Picking the Search Win: box toggles the setting between Disabled and Enabled. With the Search Win: box set to Enabled, the search window is displayed on the screen.
Pick the P&P Search Window *box on the* Define Window *the menu.*	Picking the P&P Search Window box displays the "handles" on the window.



Using the Search Window *(continued)*

Your Action	Comments
Pick and place the search window so it covers the area you are going to search.	



Pick the Learn: *box.*

When you pick the Learn: box, the search window "learns" the position of all the features within its borders.

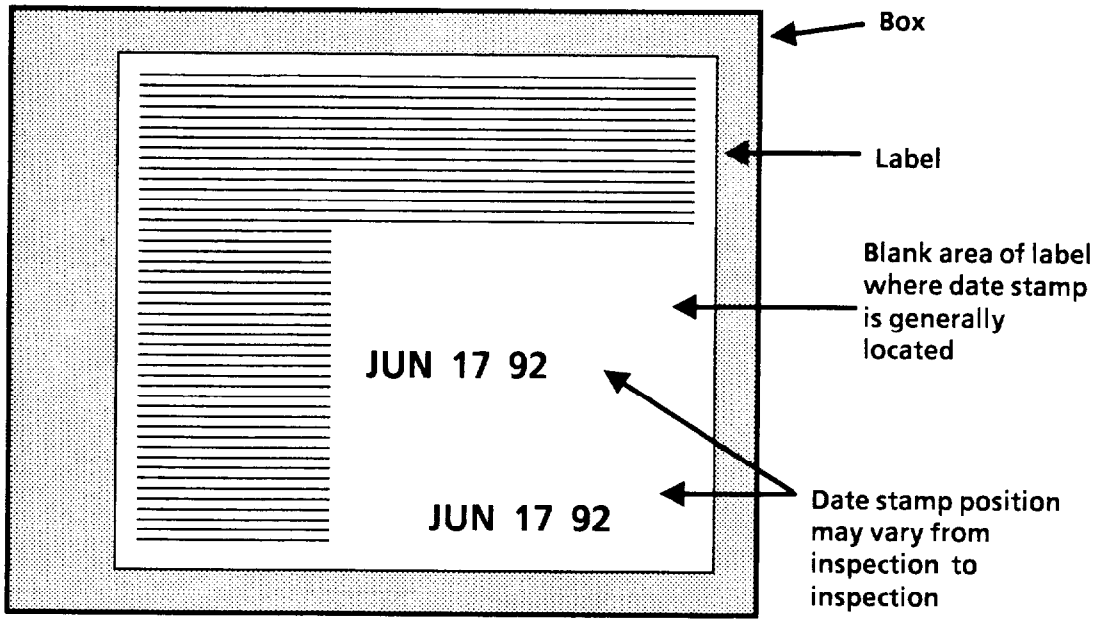
Note: If you adjust the position of the search window, you must pick the Learn: box again after the position adjustment so the search window can relearn the contents.

In the example above, only the character string (**A B C 1 2**) appears in the search window. During operation, if the position of the character string shifts from inspection to inspection, but remains within the area of the search window, the search window will locate the character string position, and will shift the OCR window position accordingly, so that that character string is inspected.

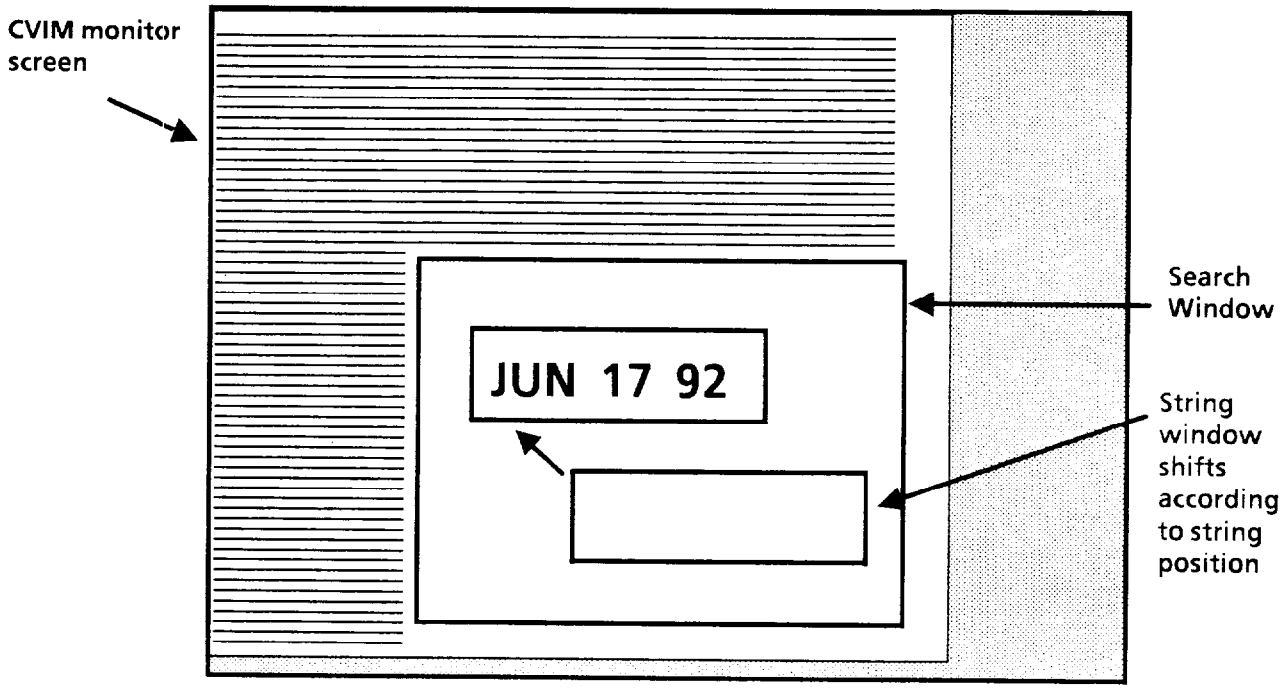
Using the Search Window (continued)

Example of Using the Search Window

Suppose in your application you want to use an OCR window to inspect the date stamped on the label of a box. The stamped date is to be located somewhere within a blank area on the label, but the position of the stamped date may vary from one label to the next.


Box
Label
Blank area of label where date stamp is generally located
JUN 17 92
JUN 17 92
Date stamp position may vary from inspection to inspection

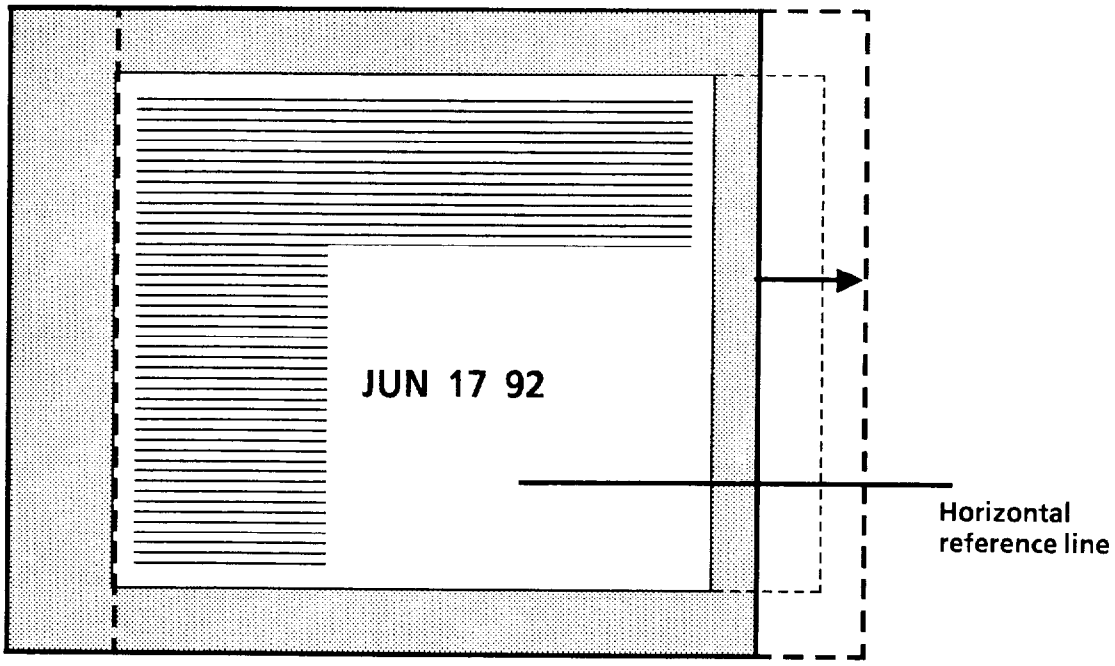
To solve this, during setup you would place the OCR window over the character string in a typical position; you would then place the search window over the entire blank area where the character string might appear. Then, wherever the date stamp was placed within in the blank area, the OCR window would automatically be shifted there to cover it.



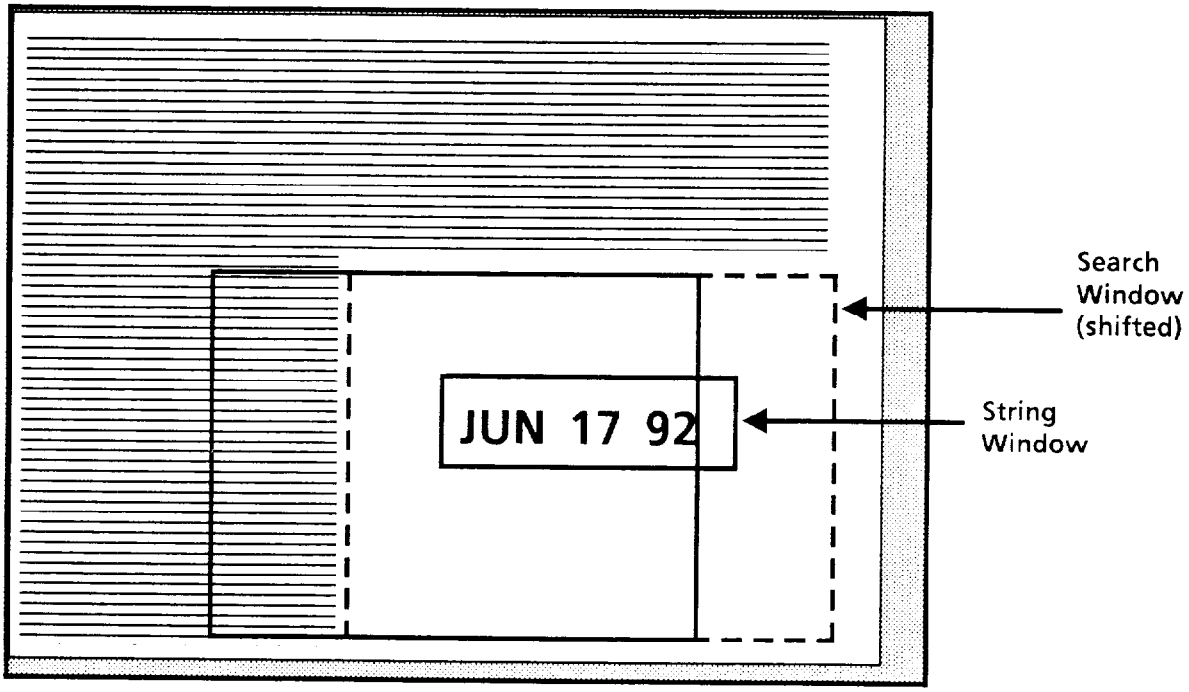
Using the Search Window (continued)

Example of Using the Search Window and a Reference Line

Now, in the same application, suppose that the box position also may shift horizontally during operation, so that the label position also shifts.



To solve this, you would use a horizontal reference line to gage the label shift, and assign the OCR window to the reference line. Then, during inspections, the shift detected by the reference line would be applied to the *search window*. The search window would be shifted so it would still cover the blank area.



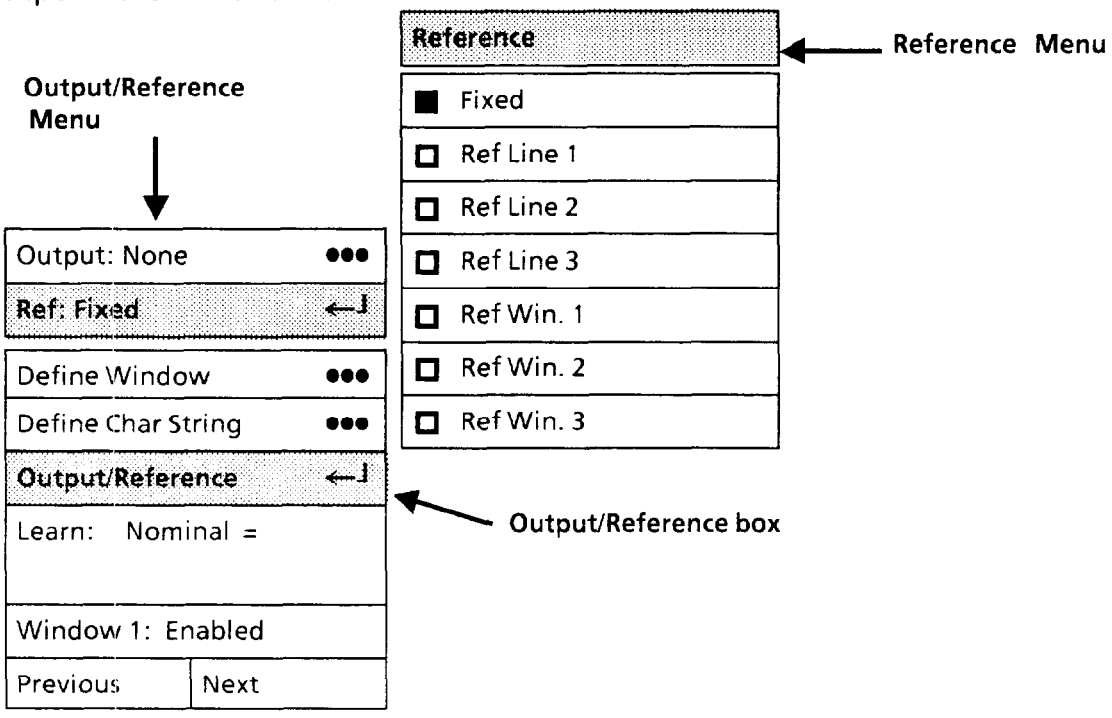
Assigning the Reference Tool

You can configure the OCR window so that one of the six reference tools provides shift compensation to the string window, or, if the search window is used, to the search window (**Note:** character windows automatically follow the positioning of the associated string window). During an inspection, if the reference tool detects a shift of the workpiece feature, the reference tool shifts the corresponding window the same amount and direction (for more information about reference tools, see the *CVIM User's Manual*).

Note: The OCR windows **do not accept rotation compensation** from an assigned reference tool; only horizontal and vertical shifting is applied to OCR windows.

To assign a reference tool to the currently selected window:

Your Action	Comments
Pick the Output/Reference *box on the* Window *menu.*	When you pick the Output/Reference box, the Output/Reference menu is displayed.
Pick the Ref: *box on the* Output/Reference *menu.*	When you pick the Ref: box, the Reference menu appears.



Note that the Fixed box has a shaded square (□), indicating that a reference tool is not assigned to the currently selected window. Also note that the *available* reference tools are in *light* type on the screen; you cannot pick the tools listed in *dark* type.

Pick the appropriate reference tool from the menu.	Picking one of the available reference tools assigns the currently selected window to that reference tool.

Assigning an Output Line

You can assign the results of the OCR window to a specific CVIM output, using the Output menu box (**Note:** To assign the window results to an output, there must be a "results" output available – for more information on assigning results, see the *CVIM User's Manual*).

Note that, unlike other CVIM inspection windows, the OCR window does not use *range limits*; there is no fault range or warning range for OCR window results. Instead, the OCR window results reflect the success of the "read" or "match" operation, as described below:

- For a "read" operation (that is, when the Read: box is set to Letters, Numbers, Letters / Numbers, or Numbers / Letters), the assigned results output is activated only when at least one character is not identified. *As long as all characters are identified, the inspection is considered a success, and there is no output activation.*

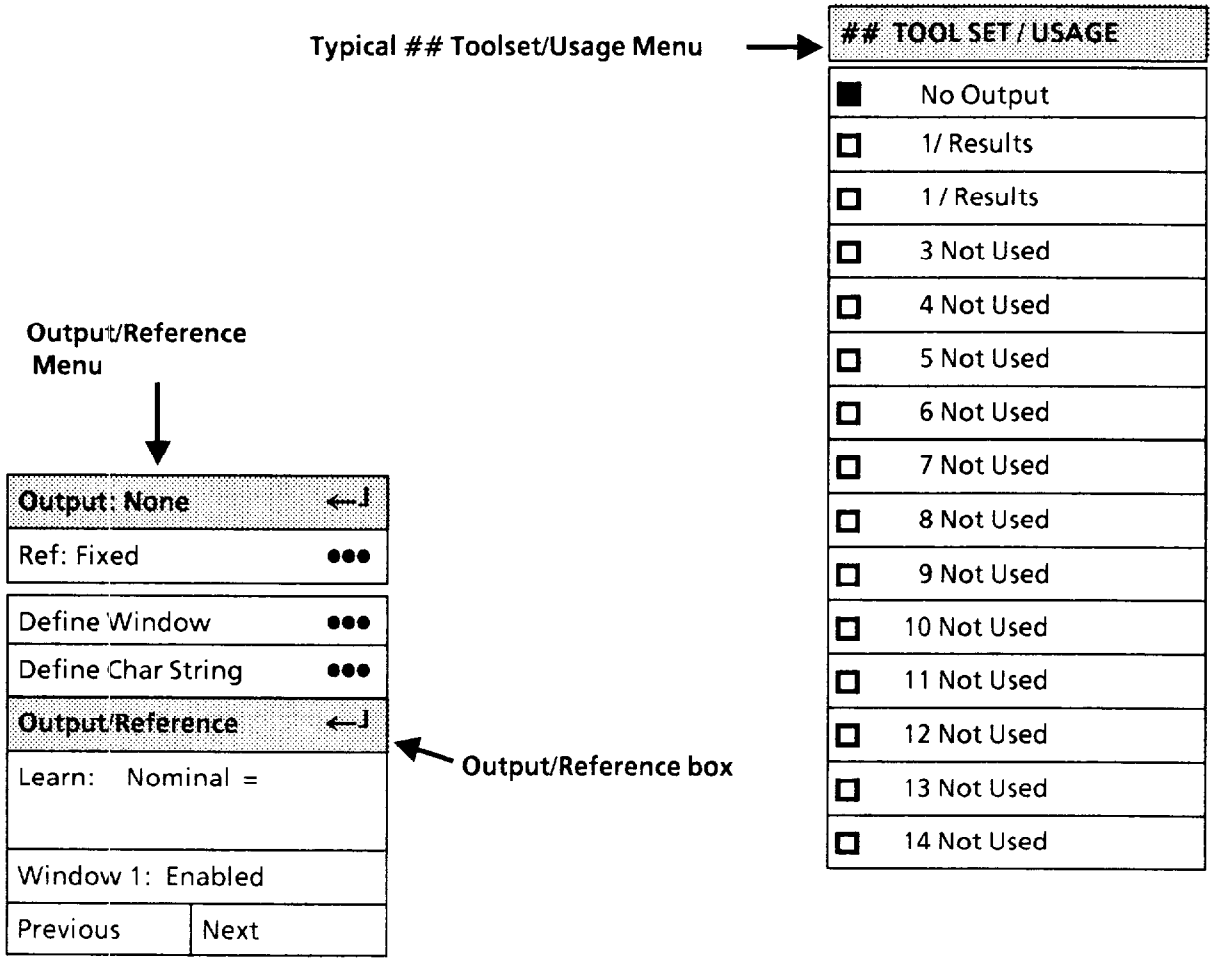
- For a "match" operation (that is, when the Read: box is set to Match String), the assigned results output is active when at least one character in the inspected string, as identified by the OCR window, does not match the corresponding character(s) in the user-defined match string. *As long as all inspected characters match the user-defined match string, the inspection is considered a success, and there is no output activation.*

  Note: Failure of the search window and/or reference tools will cause the associated OCR window to fail.

Assigning the Output Line *(continued)*

Use the following steps to assign an output to the currently selected window.

Your Action	Comments
Pick the Output/Reference *box on the* Window *menu.*	When you pick the Output/Reference box, the Output/Reference menu is displayed.
Pick the Output: *box on the* Output/Reference *menu.*	When you pick the Output: box, the ## Toolset/Usage menu appears. This menu shows the output line functions you assigned to the Output Assignment menu (see the *CVIM User's Manual* for more information).



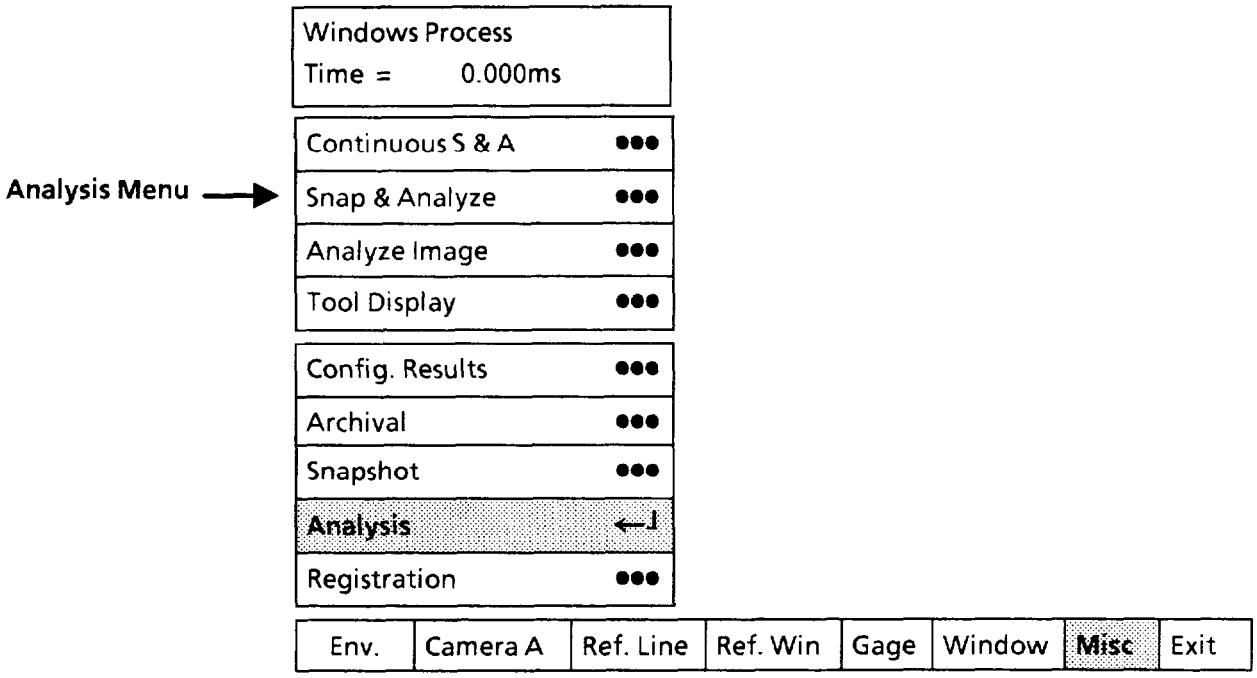
Note that the No Output box has a shaded square (□), indicating that no output is assigned to the currently selected window. Also note that the *available* outputs are in *light* type; you cannot pick the outputs listed in *dark* type.

Pick the appropriate output from the menu.	Picking one of the available outputs assigns that output to the currently selected window.

Note: If you prepared an Output Line Planning Sheet (see Appendix A in the *CVIM User's Manual*), refer to it for the assignment for this window.

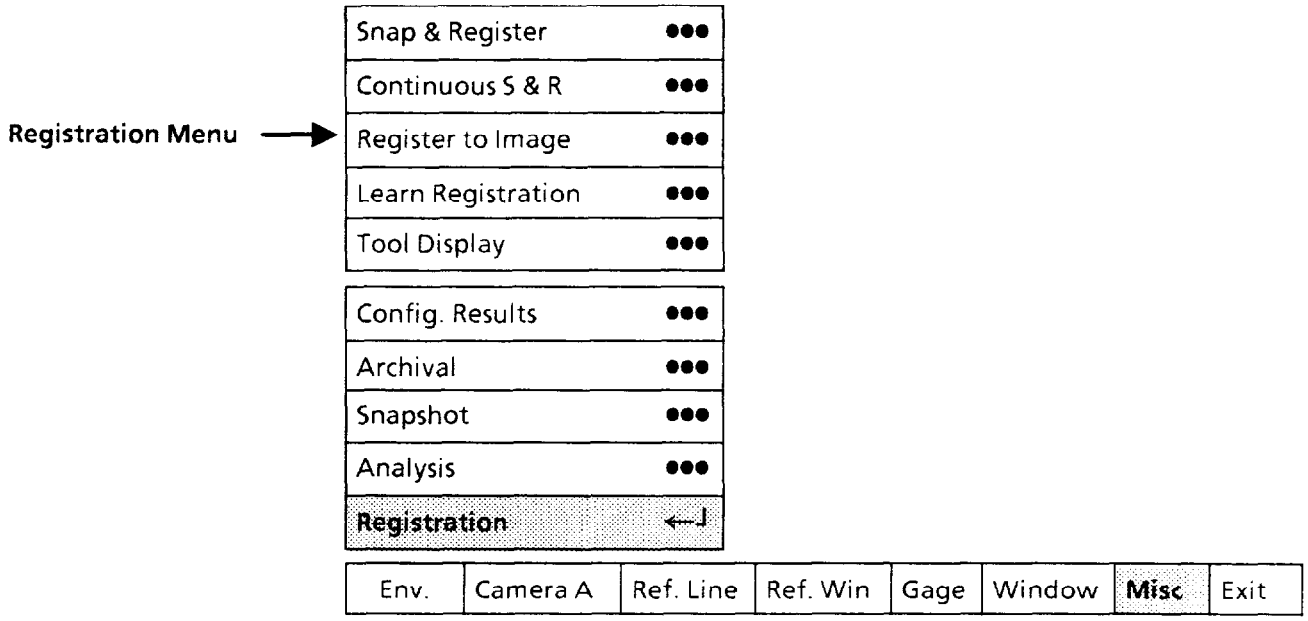
Using the Analysis *Function*

You can use the CVIM module's *analysis* capability to display the inspection time of the OCR windows. Refer to the *CVIM User's Manual* for information on the analysis tools.



Using the Registration *Function*

Upon returning to setup mode from the run mode, you can use the CVIM module's *registration* capability to automatically realign the OCR string window with the character string, if the character string has shifted from its original position in the image. Refer to the *CVIM User's Manual* for information on the registration functions. **Note:** To use Registration, you must be using the search window, and/or a reference line or a reference window assigned to the OCR window.



Chapter 5 OCR Adjustment Features

Chapter Objective

The objectives of this chapter are to describe the OCR adjustment features, and to describe how and when to use them.

Overview: OCR Adjustment

The OCR-PAK option is designed for applications which meet certain requirements for character print quality, as set forth in Chapter 2, *Application Considerations and Requirements*. That is, in order for an OCR window to work successfully, the characters to be recognized should meet spacing, contrast, and other appearance requirements.

In some cases, through the use of one or more of the OCR adjustment features, it may be possible to accommodate print quality shortcomings, and recognize characters which do not fully meet print quality recommendations.

The OCR adjustment features are:

- Reconnect: Helps the OCR window to overlook *small breaks* in the strokes of characters.
- Char Width: Helps the OCR window to separate and recognize characters *connected* by ink overflow.

Two "diagnostic" features also discussed in this chapter are:

- Disp. Chars: Displays the *appearance* of the inspected characters, as seen by the CVIM.
- Show Matrix: Displays the *mathematical coding* of an inspected character, as stored by the CVIM.

Important: The OCR adjustment features described in this chapter are intended to help improve the performance of the OCR operation, particularly in situations of diminished character quality, as described for each OCR adjustment feature. It is up to the user to apply the appropriate OCR adjustment feature(s) for the application, and to review and assess the resulting performance of the OCR operation.

When to Use OCR Adjustments

The OCR adjustment features are intended for use only after initial setup and trial run of your OCR configuration. If, upon completion of a trial run, you do not obtain the intended results, you should first address any possible configuration adjustment requirements, such as window placement, thresholding, Read Mode setting, and so forth.

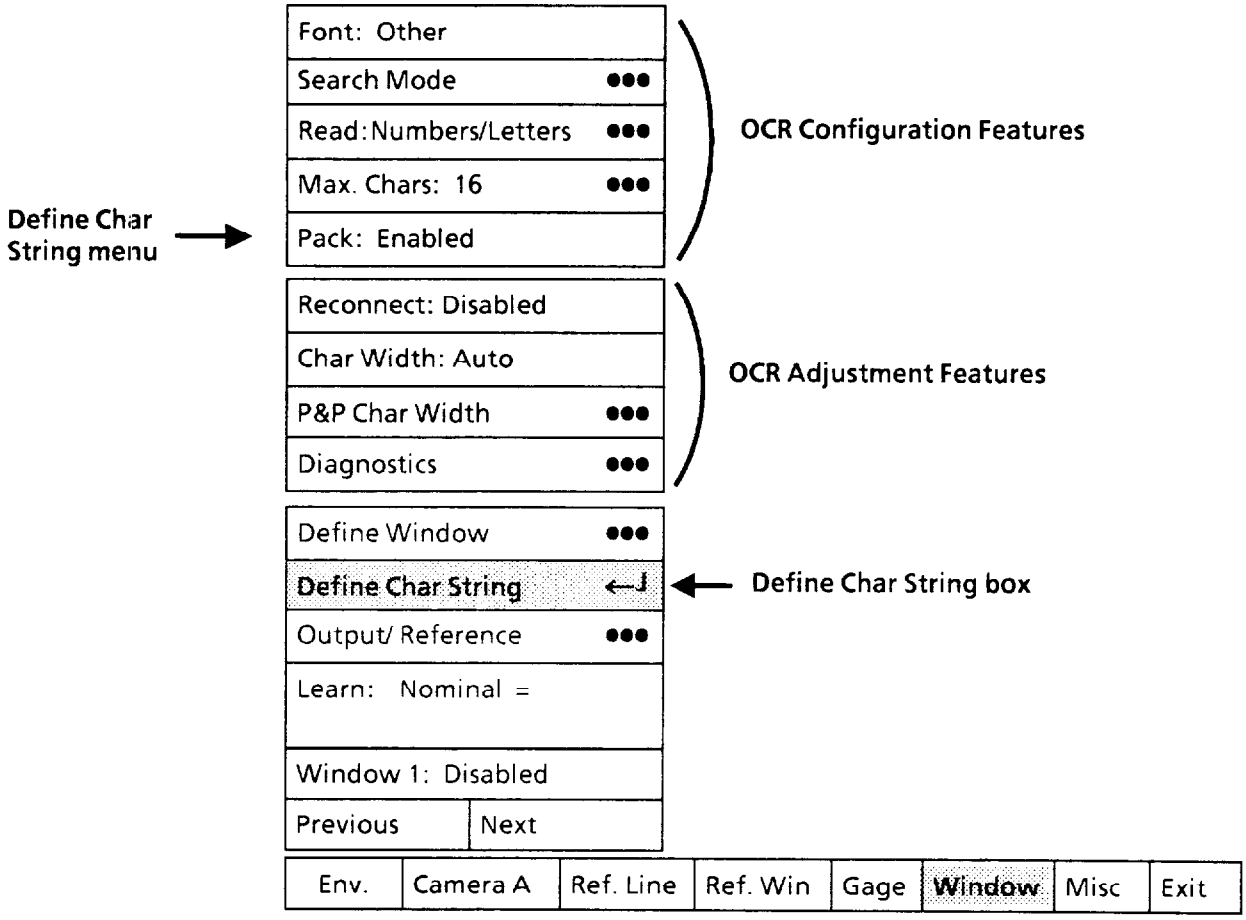
When to Use OCR Adjustments *(continued)*

Then, after optimizing your configuration, if it is determined that you cannot successfully recognize characters due to diminished character quality (and not due to inadequate configuration), you should apply the OCR adjustment features as appropriate for your situation.

Using the OCR Adjustment Features

To use the OCR adjustment features, you must access the Define Char String menu.

Your Action	Comments
Pick the Window *box on the* Main *menu.*	When you pick the Window box, the *Window* menu appears.
Pick the Define Char String *box on the* Window *menu.*	When you pick the Define Char String box, the Define Char String menu pops up. **Note:** The Define Char String box is not available unless the window operation is already set to *OCR* (see Chapter 4 for window configuration information).



Using the OCR Adjustment Features (continued)

The *OCR configuration* features are used to set most of the parameters for the OCR inspection, and are discussed in Chapter 4. The *OCR adjustment* features are intended for use in special cases as discussed in this section.

Using Reconnect

The Reconnect function can be used in some cases to allow the OCR window to overlook a small break that may occur in an inspected character, which would otherwise make the character unrecognizable.

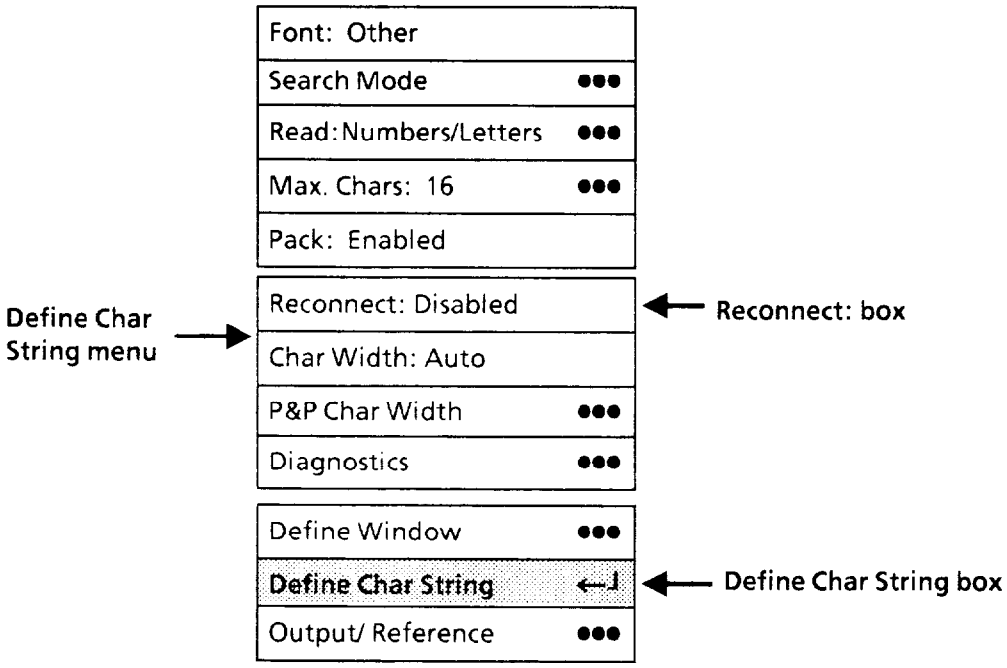
Examples of characters with breaks.

S B

The Reconnect function is intended for use, then, in applications where small breaks in characters are in evidence.

To enable the Reconnect function, pick the Reconnect: box on the Define Char String menu.

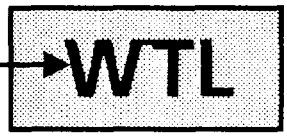
Your Action	Comments
Pick the Reconnect: *box to enable or disable the function.*	Picking the Reconnect: box toggles the setting between Disabled and Enabled.



Using Char Width

The OCR-PAK option provides a function which allows you to set the width for inspection of characters. This "character width" function is intended to be of use in situations where characters in an inspected string appear to be connected, though they are properly spaced otherwise.

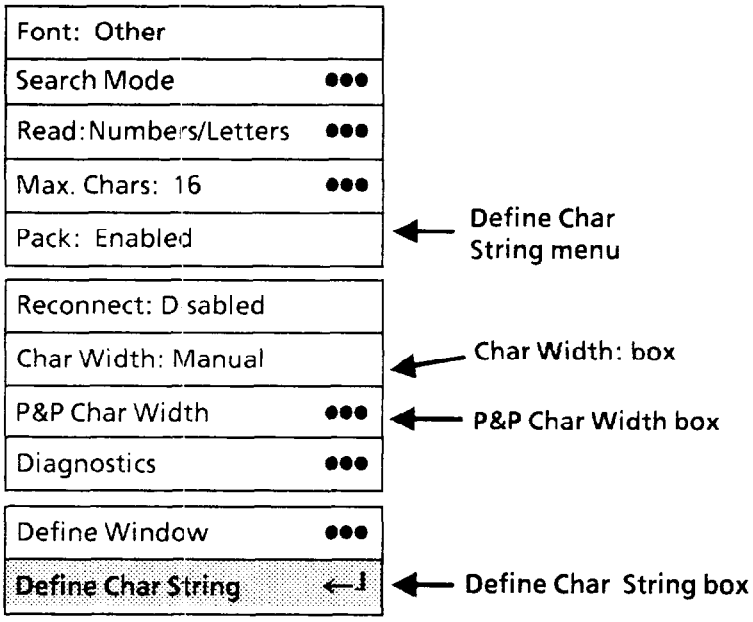
Example of connected characters – the W and T characters would not ordinarily be recognized.

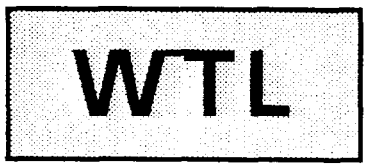


Ordinarily, characters which appear to be connected in the OCR window during inspection are not recognized as separate characters; the connected characters are regarded by the OCR window as a single, unrecognizable character. However, setting the character width can enable the OCR window to separate joined characters, and to individually recognize each character.

To set the character width, you use the Char Width: box and the P&P Char Width box on the Define Char String menu.
Note: Before you complete the following steps, you should first place the OCR window over a character string in the setup image, and define at least the Search Mode.

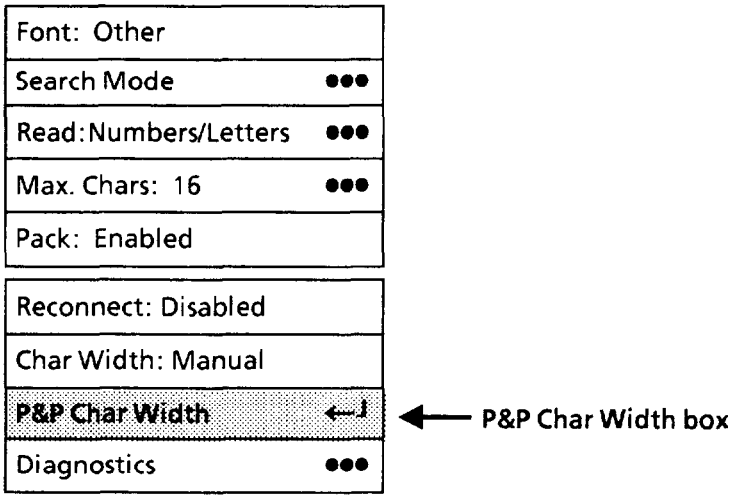
Your Action	Comments
Pick the Char Width: box *box on the* Define Char String *menu to select* Manual.	When you pick the Char Width: box, the setting toggles from Auto to Manual. With Manual selected, the P&P Char Width box is enabled.

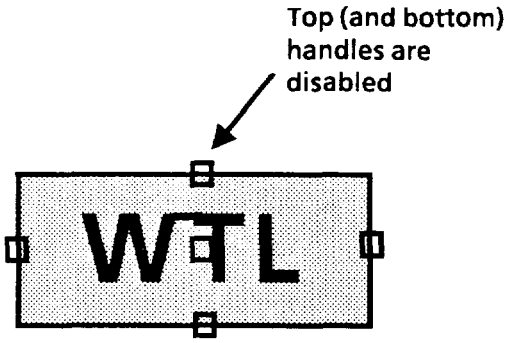




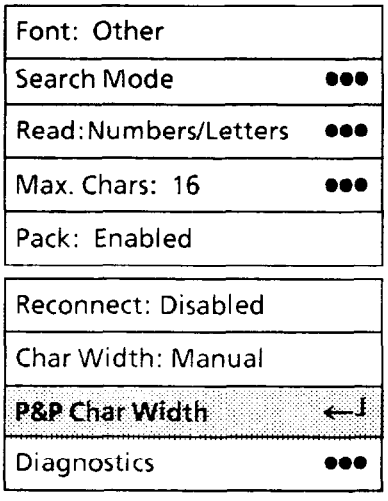
Using Char Width *(continued)*

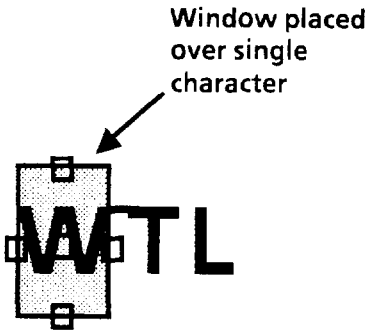
Your Action	Comments
Pick the P&P Char Width *box on the* Window *menu.*	When you pick the P&P Char Width box, the character width window appears. It is initially the same size as the string window, and it has handles for picking and placing. **Note:** For horizontal character strings, the top and bottom handles are disabled; for vertical strings, the left and right handles are disabled.





Pick and place the window to define the character width.	Using the side handles (for horizontal strings), place the window so that it surrounds a single character representative of typical character width (the Char Width function automatically adjusts the width ±25 percent to accommodate variance in width from character to character).



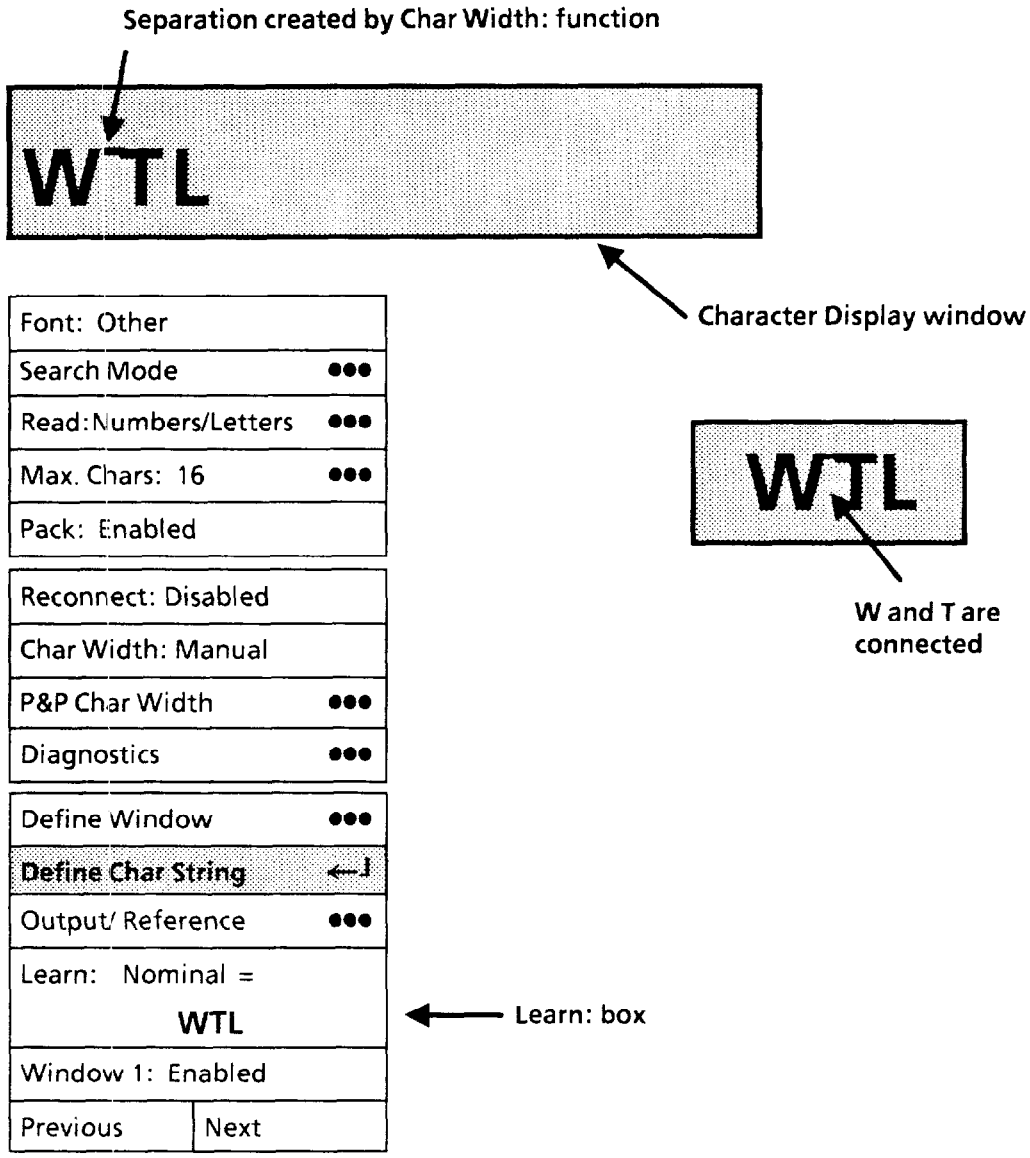


Note: If you set the width too narrow, the OCR window may split wide characters into two unrecognizable characters. If you set the width too wide, the OCR window may not separate the connected characters at all.

Using Char Width *(continued)*

With the Char Width: box set to Manual, the OCR window will, during inspection, separate any connected characters according to the character width you set.

You can check the effects of your character width setting by using the Learn: box, with the Disp Chars: box Enabled (see "Using Disp Chars" in this chapter); the separation the OCR window makes will appear in the displayed characters.

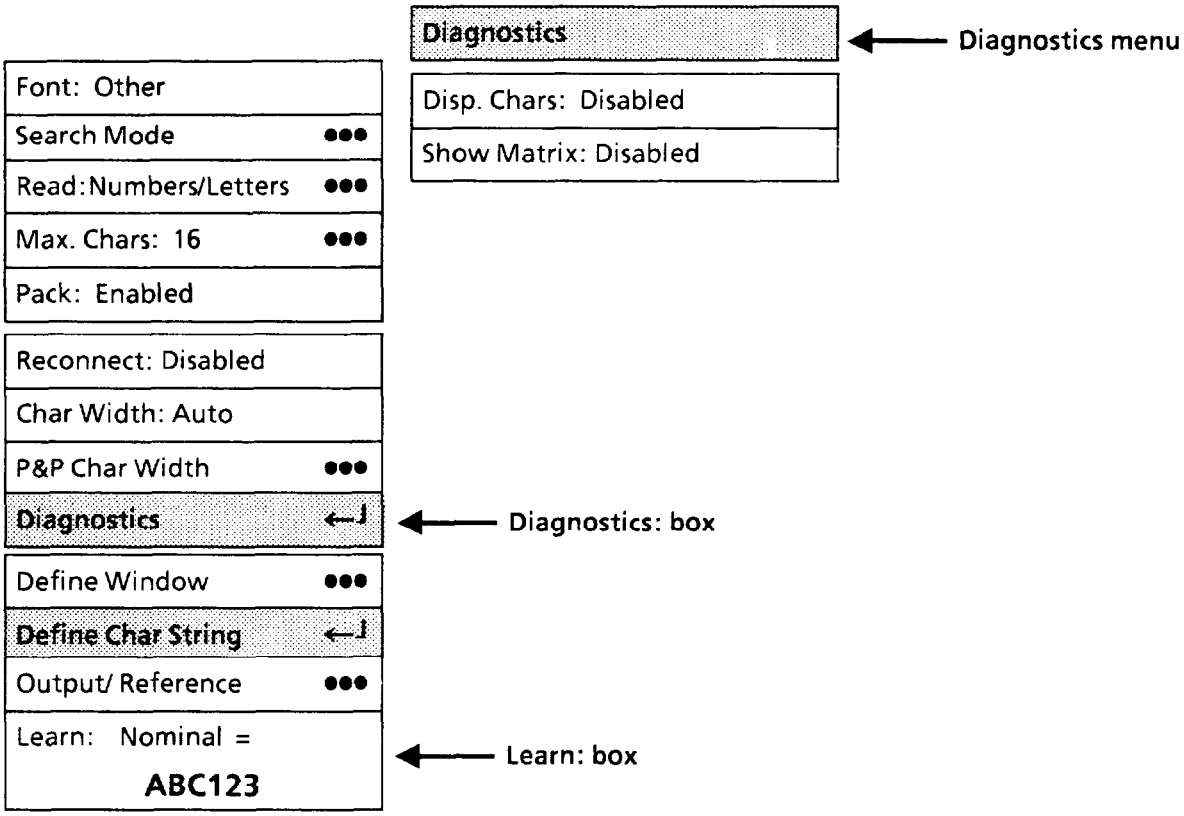


Using Diagnostics

The Diagnostics box on the Define Char String menu leads to the Diagnostics menu, which features two "diagnostic" functions, Disp. Chars, and Show Matrix.

To access the diagnostics functions, pick the Diagnostics box on the Define Char String menu.

Your Action	Comments
Pick the Diagnostics *box to display the* Diagnostics *menu.*	Picking the Diagnostics box on the Define Char String menu opens the Diagnostics menu.



To use either of the diagnostics functions, you must first configure the other OCR window parameters as appropriate, and have a character string placed in the OCR string window. Then you set either the Disp. Chars: box to Enabled, or the Show Matrix: box to Enabled (you can only enable one diagnostic function at a time). Then you pick the Learn: box on the Window menu.

The two diagnostic functions are discussed in the following two sections.

Using Diagnostics *(continued)*

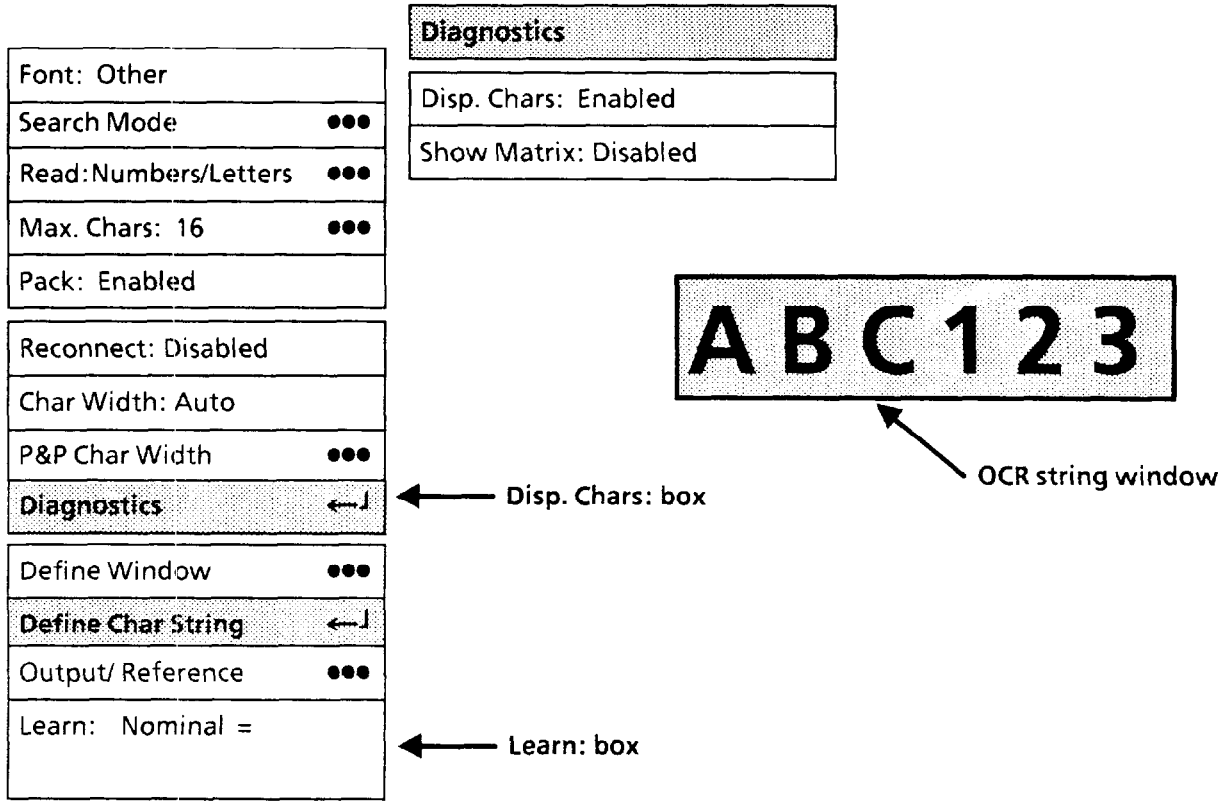
Using Disp. Chars

The Disp. Chars (or "display characters") function, used in conjunction with the Learn: box, displays the inspected characters (in a window on the monitor screen) as they are viewed by the CVIM; this may be different from the way they appear in the OCR window during setup.

To use the Disp. Chars function, you must first configure the other OCR window parameters as appropriate, and have a character string in the OCR string window. Then you set the Disp. Chars: box to Enabled, and pick the Learn: box.

For example, suppose after you have selected, placed, and configured an OCR window, you want to use the Disp. Chars function to see how the inspected characters **A B C 1 2 3**, as shown below, appear to the CVIM. Follow these steps:

Your Action	Comments
Pick the Disp. Chars:*box to change the setting to* Enabled.	Picking the Disp. Chars:box on the Define Char String menu toggles the setting from Disabled to Enabled (**Note:** If the Show Matrix: box is enabled, you must first disable it in order to enable the Disp. Chars: box).

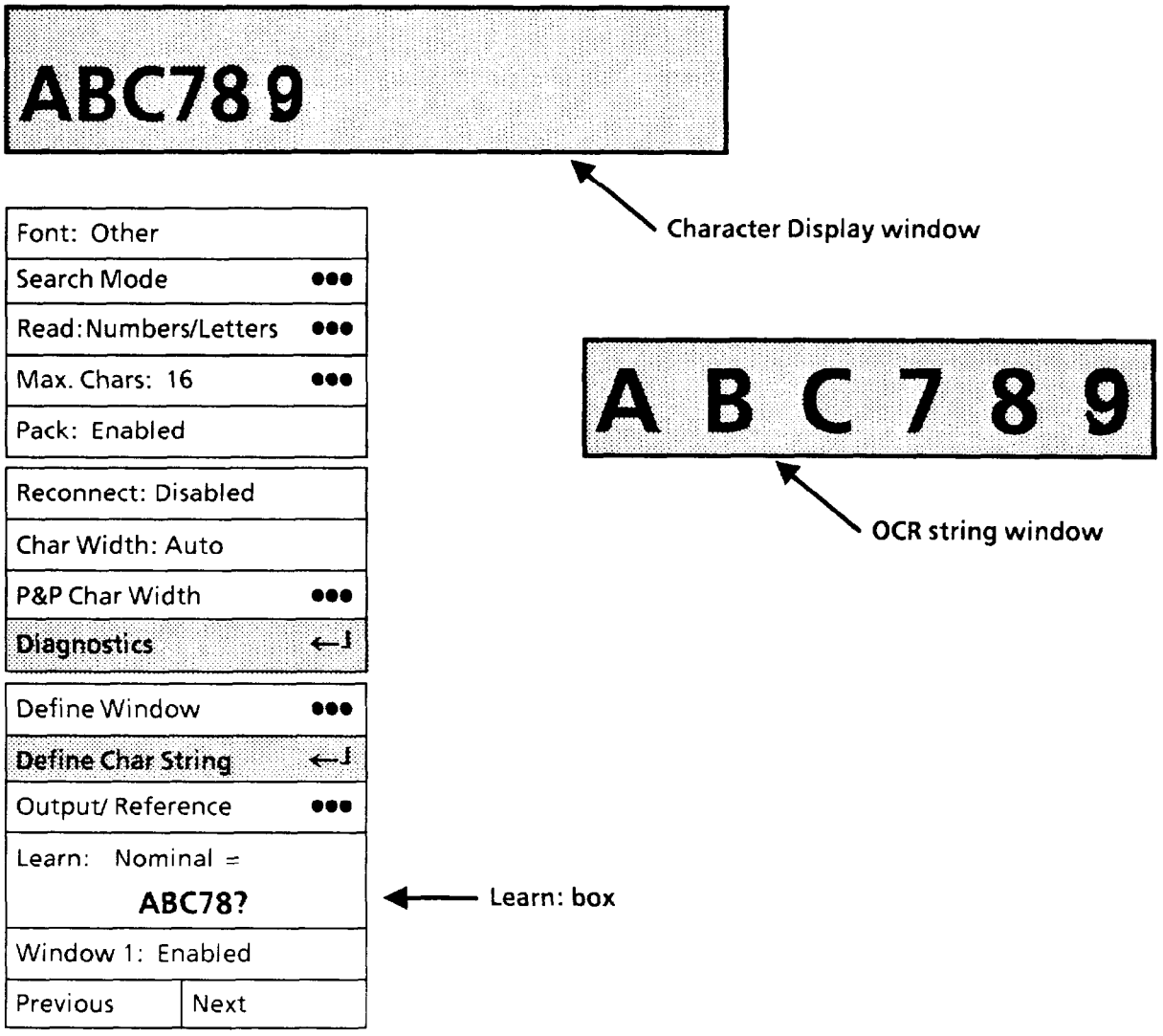


Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box causes the characters **A B C 1 2 3** to appear in the Learn: box, and displays the characters in a window at the top of the monitor screen.

Using Diagnostics *(continued)*

Using Disp. Chars *(continued)*

The Disp. Chars function can be a useful troubleshooting tool. For example, suppose the character string **A B C 7 8 9** appears in the OCR window during setup. Then when you pick the Learn box: the **9** in the inspected character string is listed as **?**. By using Disp. Chars to display characters as viewed by the CVIM, you might notice that the hook of the **9** is connected to the loop, making it unrecognizable as a 9. This shows why the **9** is listed in the Learn: box as **?**.



Once you have seen how the characters appear in the window, you can take steps to correct problems such as the one described above. For example, in the above case, changing the threshold of the string window might help "clean up" the appearance of the **9**.

Note: If necessary, you can also adjust the threshold of individual character windows in the string. See *Adjusting Character Window Thresholds* in Chapter 4.

Using Diagnostics *(continued)*

Using Show Matrix

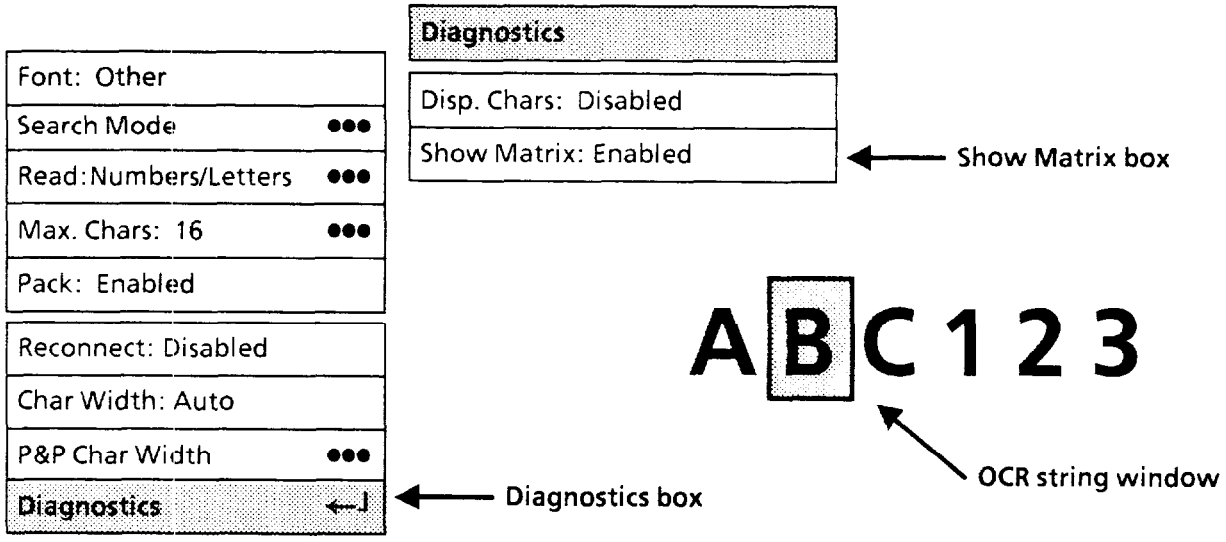
The Show Matrix function, used in conjunction with the Learn: box, displays the "matrix" of an inspected character (in a window on the monitor screen). This matrix is a set of 16 numerical expressions which represent the character and are stored in CVIM memory.

The Show Matrix function is intended for use if and when your OCR window cannot recognize a particular character because of its particular shape or appearance, despite your having adjusted other factors, such as lighting, window position, window threshold, etc. If all else fails, you can use the Show Matrix function to obtain the character's matrix. Then you can submit the matrix numbers to your local Allen-Bradley representative for application assistance.

To use the Show Matrix function, first configure the other OCR window parameters as appropriate. Then *place the OCR string window over the specific character* in the character string for which you want a matrix. Then set the Show Matrix: box to Enabled, and pick the Learn: box.

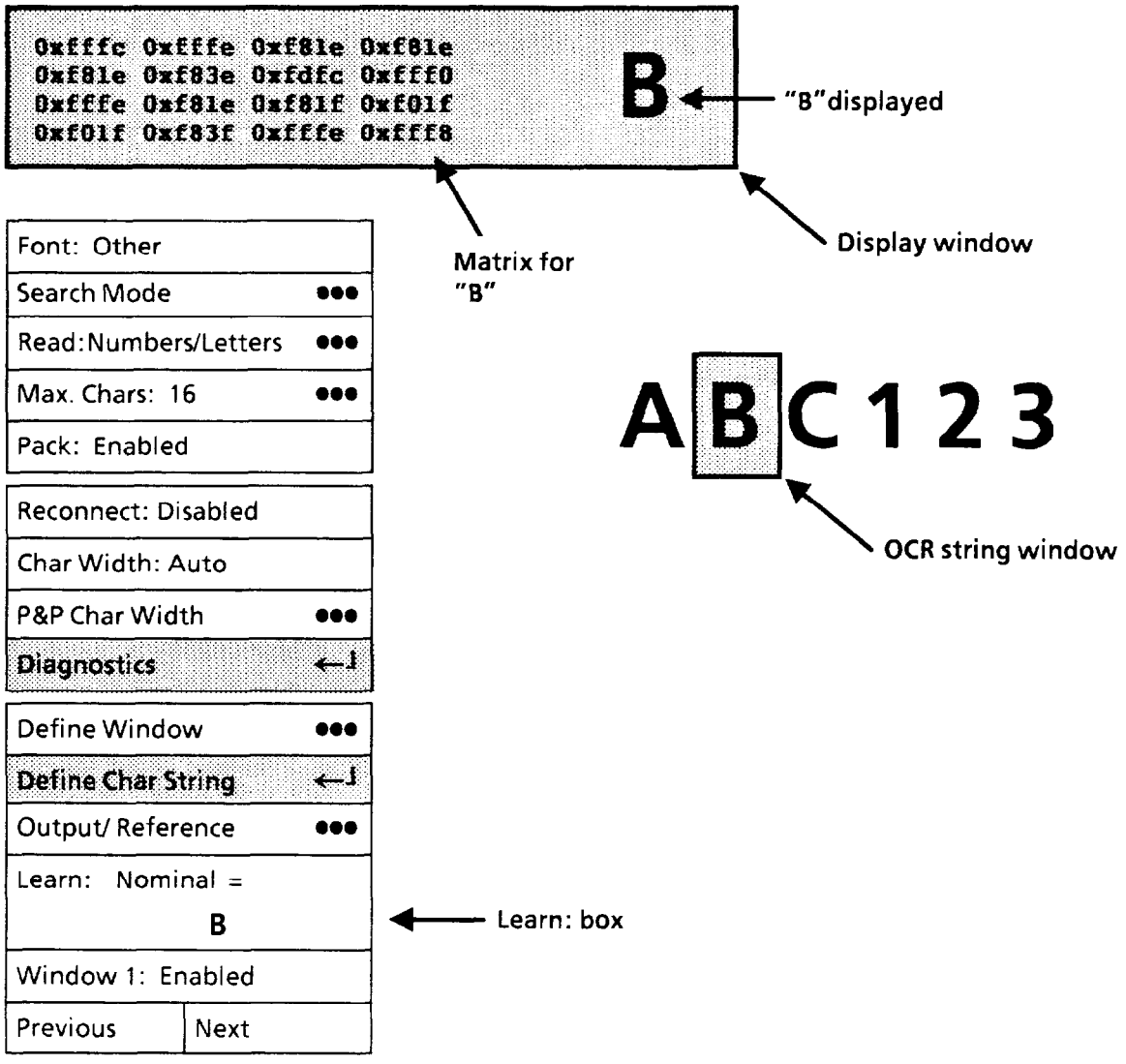
For example, suppose you want to use the Show Matrix function to obtain the matrix for the **B** in the character string **A B C 1 2 3**, shown below. Follow these steps:

Your Action	Comments
Pick the Show Matrix *box to change the setting to* Enabled.	Picking the Show Matrix box on the Define Char String menu toggles the setting from Disabled to Enabled (**Note:** If the Disp. Chars box is enabled, you must first disable it in order to enable the Show Matrix: box).



Using Diagnostics ***(continued)*** ***Using*** Show Matrix *(continued)*

Your Action	Comments
Pick the Learn: *box on the* Window *menu.*	Picking the Learn: box displays the character matrix, and the character, in a window at the top of the monitor screen.



Note: If you use the Show Matrix function with more than one character in the string window, the display window shows the matrix for the last character in the string window only.

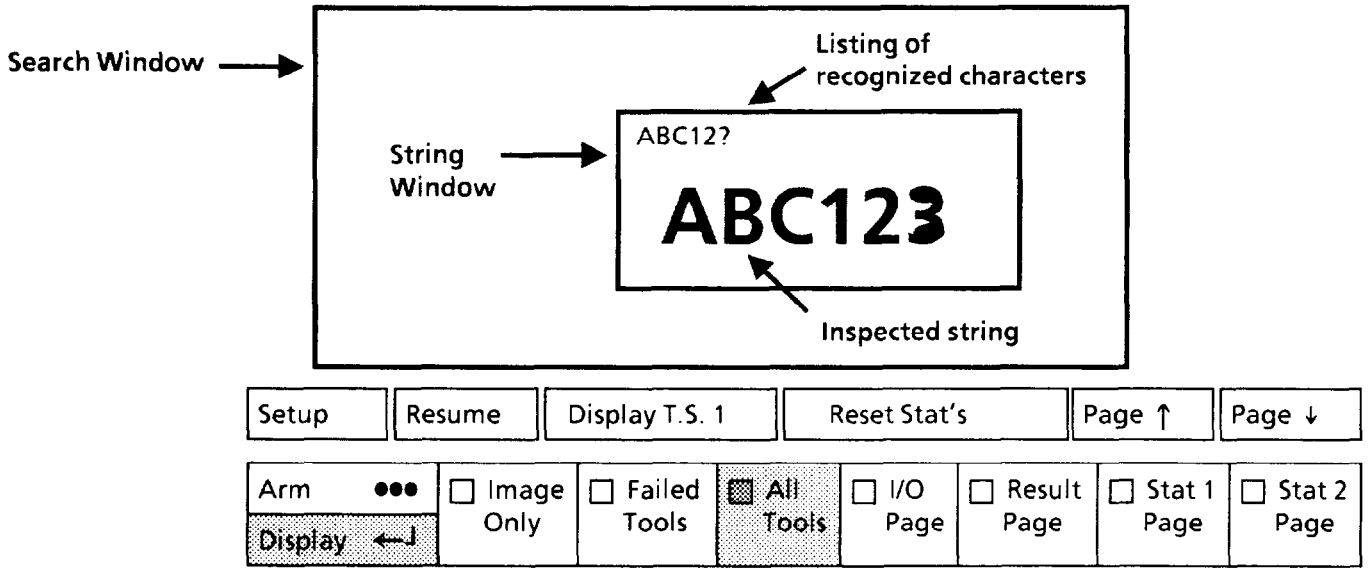
Chapter 6 Runtime Displays

Chapter Objective

The objective of this chapter is to describe how to interpret the CVIM runtime displays when using OCR windows.

Runtime Tools Display

You can display the string window and search window, if used, during runtime (refer to the *CVIM User's Manual* for more information regarding the runtime displays). A typical case of a string window and its search window as displayed during runtime is shown below:



Note that the displayed string window includes, in the upper left corner, a listing of the character string as recognized by the string window. If the window is defined for a "read" operation, any character that is not recognizable is displayed as a red ? in the character display. If the window is defined for a "match" operation, any character that does not match the corresponding character in the match string is displayed as a red ? in the character display.

The colors of the displayed windows have special meaning. The string window, and search window, if used, are displayed in *green*, if the inspection is a success. If the string window is *red*, this indicates the inspection has failed. If the search window is *green*, and the string window shifts to the middle of the search window with no character display listing, and is *red*, this means the search window has shifted the OCR window partially off the screen.

If the search window is *red*, this can indicate that the reference tool assigned to the OCR window failed, or shifted the search window partially off screen. Or else it can indicate that no features are recognized as being located in the search window.

Results Display

As with any window, the OCR window results can be displayed during runtime by picking the Result Page box on the Display menu. The window results for OCR windows are listed under only two columns – the Faults column and the Reading column. Range results do not apply to OCR windows, so the range result columns (Fail Low, Warn Low, Warn Hi, and Fail Hi) are blank.

Suppose you are inspecting a six-character string with window #1. You have Pack: set to Disabled, and Max. Chars: set to 6, so windows #2 through #7 are allocated as character windows. A typical result page displaying OCR window results is shown below:

TRIGGERS		FAULTS	Reference Lines / Windows
Accepted:	35	Master Fault: 2	
Missed:	0	Light Probe:	
Total:	35		

WINDOW	Faults	Fail Low	Warn Low	Reading	Warn Hi	Fail Hi
1.	2			ABC12?		
2.	0			A		
3.	0			B		
4.	1			C		
5.	0			1		
6.	0			2		
7.	2			?		

Setup	Resume	Display T.S. 1	Reset Stat's	Page ↑	Page ↓

Arm ●●● / Display ←┘	☐ Image Only	☐ Failed Tools	☐ All Tools	☐ I/O Page	☒ Result Page	☐ Stat 1 Page	☐ Stat 2 Page

In the above Results Page display, the Reading column lists the current characters read by the corresponding windows. Hence, for window #1, the string window, all the characters of the inspected string are listed. For windows #2 through #7, the individual characters are listed. Recognized and matching characters are listed in green. An unrecognized (or non-matching) character is displayed as a red ?.

The Faults column displays the accumulated number of window failures for each window. For any inspection in which a particular *character* window fails (that is, when a ? appears in the listed string) the Faults count for that character window is incremented. For any inspection in which at least one character windows fails, the Faults count for the *string* window is incremented.

Statistics Display

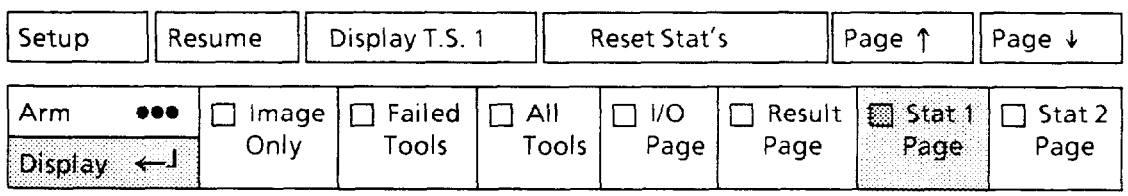
As with any tool or probe, the OCR window statistics can be displayed during runtime, by picking the Stat1 Page box on the Display menu.

The Stat1 Page statistics are based on the accumulated results for the inspections sampled. For OCR windows, these results are as follows:

- For the string window, the result, or "reading," is the number of characters recognized or matched in the inspected string. This can range from 0 to the maximum number of characters as set in the Max. Chars: box.
- For each character window, the result, or "reading," is always either a "1," if all characters in that window are recognized or matched, or a "0," if any of the characters are not recognized or do not match.

For example, suppose you are *reading* a six-character string with window #1. You have Pack: set to Disabled, and Max. Chars: set to 6, so windows 2 through 7 are allocated as character windows. A typical Stat1 Page displaying results for 150 inspections, for windows 1-7, is shown below:

PROBE 1.	Samples	Mean	Std. Dev.	Min. Reading	Max. Reading
WINDOW	Samples	Mean	Std. Dev.	Min. Reading	Max. Reading
1.	150	5.480	1.683	2	6
2.	150	1.000	0.000	1	1
3.	150	0.953	0.195	0	1
4.	150	0.986	0.114	0	1
5.	150	0.953	0.195	0	1
6.	150	0.953	0.195	0	1
7.	150	1.000	0.000	1	1



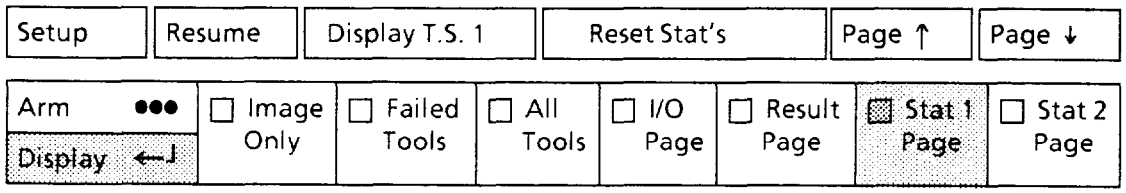
Note for window #1, the string window, the Min. Reading for the sampling is listed as 0, indicating that during at least one inspection, none of the characters were recognized at all. For window #2, a character window, the Min. Reading is 1, indicating none the readings for that window failed.

Statistics Display *(continued)*

For window #3, a character window, the Min. Reading is 0, indicating that at least one reading for that window failed; that is, the character inspected by that window was not recognized during at least one inspection.

Notice the values in the Mean column for the character windows (windows 2-7). These values can be interpreted as as percentage of success for each *character* window. This is because the Mean is an average of the window results, and the character window results are always either 1 (for pass) or 0 (for fail). So, for example, the Mean value of windows #4 is 0.986, indicating these window successfully recognized a character in 98.6% of the 150 readings (this amounts to 148 passes, 2 failures). The Mean value of window #7 is 1.000, indicating the window successfully recognized a character in 100% of the 150 readings.

PROBE 1.	Samples	Mean	Std. Dev.	Min. Reading	Max. Reading
WINDOW	Samples	Mean	Std. Dev.	Min. Reading	Max. Reading
1.	150	5.480	1.683	2	6
2.	150	**1.000**	0.000	1	1
3.	150	**0.953**	0.195	0	1
4.	150	**0.986**	0.114	0	1
5.	150	**0.953**	0.195	0	1
6.	150	**0.953**	0.195	0	1
7.	150	**1.000**	0.000	1	1



Chapter 7 Communications

Chapter Objective

The objective of this chapter is to provide information regarding CVIM communications with respect to OCR windows. Refer to this chapter if your application uses the CVIM communications ports on the chassis backplane and/or front panel, and also uses OCR windows.

Note: The information in this chapter is provided as a supplement to the *CVIM Communications Manual*. Refer to that manual where appropriate for related information.

Communications Overview

The installation of the OCR-PAK option does not *alter* the prior CVIM communications capabilities which are already available. However, when OCR windows are used, some *additional* communication commands become available; these are described in this section by communication type (i.e., remote I/O link, Pyramid Integrator™ backplane, or RS-232 port).

Furthermore, the result, configuration, and statistical data for OCR windows are different from that of other windows. These differences are discussed in this section as well.

Using the Remote I/O Link

If you use the remote I/O link to communicate with the CVIM, and you are using OCR windows, an additional type of block transfer write becomes available, which allows you to set the match string for string windows which are configured for a match operation (**Note:** To use this command, the selected CVIM host must be Remote I/O).

Set Match String – To set a new match string in an OCR string window (refer to Table 7.A):

- Set the appropriate *Toolset Request* bit (either bit 04 or 05 in word 23 in Table 7.A) to specify *toolset 1 or 2*.
- Set the three *Block Transfer Type* bits (bits 02, 01, and 00 in word 23 in Table 7.A) to 110 to specify *set match string*.
- Use the eight *Block Transfer Block Number* bits (bits 17 to 10 in word 23 in Table 7.A) to designate the string window number for which you are setting a match string. For example, set bits 10 and 11 to select window #3.
- Execute the block transfer write command, including the hexadecimally-encoded ASCII characters representing the new match string, followed by a null terminator, in the block (see example on page 7-3). **Note:** If the match string you are setting includes letters, use *upper case letters* only.

Using the Remote I/O Link *(continued)*

Table 7.A
CVIM Remote I/O Outputs (PLC to CVIM) if CVIM is Rack 02

← BIT 07 --- 17	06 --- 16	05 --- 15	04 --- 14	03 --- 13	02 --- 12	01 --- 11	00 --- 10	WORD ↓
(Reserved)***	(Reserved)***	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	20
(Not Used)	1 = Config. Transfer	1 = I/O Request	1 = Light pen Request	1 = Trigger Toolset 2	1 = Trigger Toolset 1	1 = Unlock Setup	1 = Lock Setup	
(Not Used)	1 = Display Stat 2 Page	1 = Display Stat 1 Page	1 = Display Results Page	1 = Display I/O Page	1 = Display All Tools	1 = Display Failed Tools	1 = Display Image Only	21
(Not Used)	(Not Used)	(Not Used)	Halt on Reject	1 = Freeze Next Image	1 = Freeze All Rejects	1 = Freeze First Reject	Go on reject	
1 = Enable JMB Forces	1 = Disable JMB Forces	1 = Enable JMB Outputs	1 = Disable JMB Outputs	(Not Used)	(Not Used)	1 = Post TS2 to Remote I/O	1 = Post TS1 to Remote I/O	22
1 = Credit Card Config. (8's bit)	1 = Credit Card Config. (4's bit)	1 = Credit Card Config. (2's bit)	1 = Credit Card Config. (1's bit)	1 = RAM to Credit Card	1 = Credit Card to RAM	1 = RAM to EEPROM	1 = EEPROM to RAM	
(Not Used)	(Not Used)	1 = Toolset 2 Request	1 = Toolset 1 Request	1 = Last Block (write Only)	1 = Block Transfer Type*	1 = Block Transfer Type*	1 = Block Transfer Type*	23
1 = Block Trnsfer Block No. (128's bit)	1 = Block Trnsfer Block No. (64's bit)	1 = Block Trnsfer Block No. (32's bit)	1 = Block Trnsfer Block No. (16's bit)	1 = Block Trnsfer Block No. (8's bit)	1 = Block Trnsfer Block No. (4's bit)	1 = Block Trnsfer Block No. (2's bit)	1 = Block Trnsfer Block No. (1's bit)	
1 = Force JMB Output 8 ON**	1 = Force JMB Output 7 ON**	1 = Force JMB Output 6 ON**	1 = Force JMB Output 5 ON**	1 = Force JMB Output 4 ON**	1 = Force JMB Output 3 ON**	1 = Force JMB Output 2 ON**	1 = Force JMB Output 1 ON**	24
(Not Used)	(Not Used)	1 = Force JMB Output 14 ON**	1 = Force JMB Output 13 ON**	1 = Force JMB Output 12 ON**	1 = Force JMB Output 11 ON**	1 = Force JMB Output 10 ON**	1 = Force JMB Output 9 ON**	
1 = Force JMB Output 8 OFF**	1 = Force JMB Output 7 OFF**	1 = Force JMB Output 6 OFF**	1 = Force JMB Output 5 OFF**	1 = Force JMB Output 4 OFF**	1 = Force JMB Output 3 OFF**	1 = Force JMB Output 2 OFF**	1 = Force JMB Output 1 OFF**	25
(Not Used)	(Not Used)	1 = Force JMB Output 14 OFF**	1 = Force JMB Output 13 OFF**	1 = Force JMB Output 12 OFF**	1 = Force JMB Output 11 OFF**	1 = Force JMB Output 10 OFF**	1 = Force JMB Output 9 OFF**	
1 = Reset Counters	1 = Reset Stats	1 = Page Down	1 = Page Up	1 = Resume Control	(Not Used)	1 = Display Toolset 2	1 = Display Toolset 1	26
(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	
(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	27
(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	(Not Used)	

*Set these three bits to specify the type of block as follows: 001 = Results, 010 = Configuration, 100 = Template, 101 = Statistics, 111 = Programmable Results Block Write, 110 = Set Match String

**If both ON & OFF bits are set, the output is forced OFF.

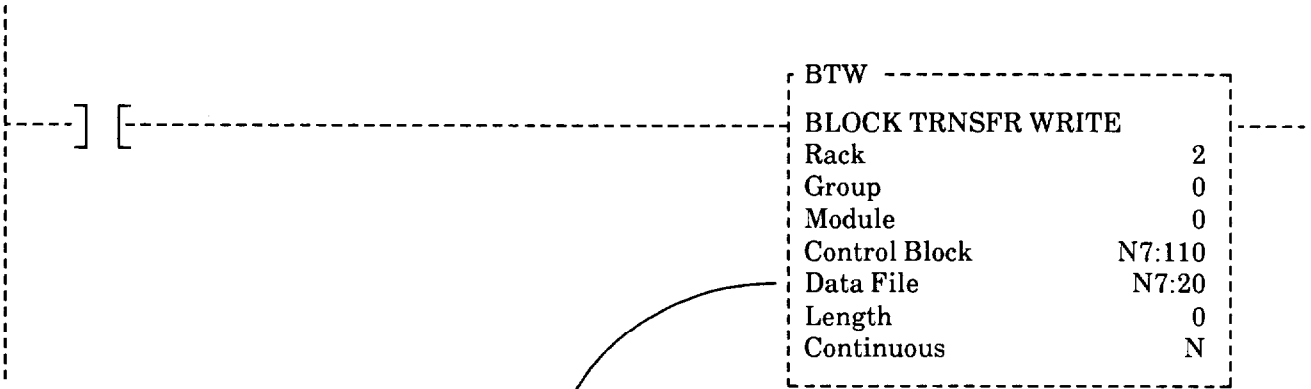
***Do not write to these bits.

Using the Remote IIO Link (continued)

Note: If the match string you send is not a valid match string, the CVIM module will not accept the new match string, and will set the Configuration Fault discrete bit.

Shown below is an example of a block transfer write with the associated data file block. The data file block shows file N7:20 containing the match string **A B C D 1 2 3**. The match string characters are hexadecimally-encoded ASCII.

Note: Decimal points ("." or "," *international*) in the match strings, or in OCR window results when using match strings, are transmitted as ASCII period (.) or comma (,), respectively. Decimal points ("." or "," *international*) in non-match string OCR window results, are transmitted as ASCII period (.).



A B C D 1 2 3 (null)

Data File Block

Files										
N7:20	41 42	43 44	31 32	33 00	00 00	00 00	00 00	00 00	00 00	00 00
N7:30	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00
N7:40	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00
N7:50	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00
N7:60	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00	00 00

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.

Using the RS-232 Port

If you use the RS-232 port to communicate with the CVIM, and use OCR windows, some additional commands become available. This section first discusses the ASCII commands, and then the DF1 commands.

Note: Refer to the *CVIM Communications Manual for* ASCII protocol description conventions, and other information related to RS-232 communication.

ASCII Commands

This section discusses three ASCII protocol commands which can transfer information involving OCR windows:

- Read Inspection Results
- Read Inspection Results (OCR)
- Set Match String

Note: Decimal points (“.” or “,” *international*) in the match strings, or in OCR window results when using match strings, are transmitted as ASCII period (.) or comma (,), respectively. Decimal points (“.” or “,” *international*) in non-match string OCR window results, are transmitted as ASCII period (.).

Read Inspection Results – This is the same command as listed in The *CVIM Communications Manual.* Use this command to read the OCR string window result of the *last inspection* – the result returned is the character string read by the window.

Command Format:

>RRx, TSnW, d[CR] *Reads the character string from the specified string window.*
x *= number of times command is repeated (optional, default = 1)*
n *= Tool set number.*
d *= Window number.*

For example: Suppose window #1 of toolset #2 is a string window, and the recognized string is **A B C D E**.

This command –

>RR, TS2W, 1[CR]

will return the ASCII-encoded characters of the string:

[CR] [LF]

ABCDE [CR] [LF]

ASCII Commands (continued)

Read Inspection Results – OCR – Use this command to list the results of the *last inspection* from all the OCR string windows in the specified tool set.

Command Format:

>RRx, TSnOCR[CR] *Reads the character strings from the specified tool set.*
x *= number of times command is repeated (optional, default = 1)*
n *= Tool set number.*

For example: Suppose window #1 and window #8 of toolset #1 are string windows, and the recognized strings are **1 2 3 4** and **A B C D**, respectively, for the last inspection.

This command –

>RR, TS1OCR [CR]

will return the ASCII-encoded characters of the two strings:

[CR] [LF]
1234 [CR] [LF]
ABCD [CR] [LF]

Set Match String – Use this command to set the match string for a string window which is configured for a match operation (**Note:** To use this command, the selected CVIM host must be RS-232).

Command Format:

>SM, TSnWd, (string) [CR]
Sets the match string for the specified string window.
n *= Tool set number.*
d *= Window number.*
(string) *= characters (match string)*

Note: If the match string you are setting includes letters, use *upper case letters* only.

For example: Suppose window #9 of tool set 1 is a string window set for match string operation.

This command –

>SM, TS1W9, A B C D * * * [CR]

will set the match string of window #9 to **A B C D * * *.**

Note: If the match string you send is not a valid match string, the CVIM module will not accept the new match string, and will set the Configuration Fault discrete bit.

DF1 Commands

This section discusses three DF1 protocol commands which can transfer information involving OCR windows:

- Read Results
- Read Results (OCR)
- Set Match String

Note: Decimal points ("." or "," *international*) in the match strings, or in OCR window results when using match strings, are transmitted as ASCII period (.) or comma (,), respectively. Decimal points ("." or "," *international*) in non-match string OCR window results, are transmitted as ASCII period (.).

Read Results – This is the same command as the DF1 ***Read Results Command*** in Chapter 5 of the *CVIM Communications Manual.* Use this command to read a specific OCR string window result from the *last inspection.* The result returned is the character string read by the window.

Command Format:

07	n Times (H)	n Times (L)	x	17	z

Where:
07 = the read result command
n Times (H) = repeat number (high byte)
n Times (L) = repeat number (low byte)
x = tool set number, where
04 = tool set #1
05 = tool set #2
17 = window
z = window number

For example: Suppose window #1 of toolset #1 is a string window, and the recognized string is **1 2 3 4**.

This DF1 command –

DLE STX 07 00 01 04 17 01 DLE ETX BCC

will return the hexadecimally-encoded ASCII characters of the string – terminated by the null character (00):

DLE STX 31 32 33 34 00 DLE ETX BCC

DF1 Commands *(continued)*

Read Results – OCR – This is basically the same command as the DF1 ***Read Results Command*** in Chapter 5 of the *CVIM Communications Manual*. The difference is, with this command, you specify OCR results. Use this command to list the results of the *last inspection* from *all* the OCR string windows in the specified tool set.

Command Format:

07	n Times (H)	n Times (L)	x	20

Where:
- ***07*** = the read result command
- ***n Times (H)*** = repeat number (high byte)
- ***n Times (L)*** = repeat number (low byte)
- ***x*** = tool set number, where
  - 04 = tool set #1
  - 05 = tool set #2
- ***20*** = OCR results

For example: Suppose window #1 and window #8 of toolset #1 are string windows, and the recognized strings are **1 2 3 4** and **5 6 7 8**, respectively, for the last inspection.

This DF1 command –

DLE STX 07 00 01 04 20 DLE ETX BCC

returns the hexadecimally-encoded ASCII characters of the two string windows – the strings are each terminated by the null (00):

DLE STX 31 32 33 34 00 35 36 37 38 00 DLE ETX BCC

DF1 Commands *(continued)*

Set Match String – Use this command to set the match string for a string window which is configured for a match operation (**Note:** To use this command, the selected CVIM host must be RS-232).

Command Format:

1A	x	17	z	(string)

Where:
- ***1A*** = the Set Match String command
- ***x*** = tool set number, where
  - 04 = tool set #1
  - 05 = tool set #2
- ***17*** = window
- ***z*** = window number
- ***(string)*** = characters (match string)*

***Note:** The string must be hexadecimally-encoded ASCII, and must be terminated with the null (00). Use upper case only for letters.

For example: Suppose window #9 of tool set 2 is a string window set for match string operation.

This DF1 command –

DLE STX 1A 05 17 09 31 32 33 34 35 36 00 DLE ETX BCC

will set the match string of window #9 to **1 2 3 4 5 7.**

Note: If the match string you send is not a valid match string, the CVIM module will not accept the new match string, and will set the Configuration Fault discrete bit.

Using the Pyramid Integrator Backplane

Read this section if you use the Pyramid Integrator backplane to communicate with the CVIM, and you are using OCR windows.

Note: Refer to Pub. No. 5000-2.3 (Allen-Bradley Pyramid Integrator Technical Overview) for a description of the basic hardware components and valid configurations.

Using the Backplane

Through the backplane, you can access an area of memory called Shared Memory. Shared Memory contains:

- CVIM Discrete Bit Information (refer to Appendix B in the *CVIM Communications Manual*).
- Results Data (refer to Appendix C in the *CVIM Communications Manual*).
- In addition, you can access the CVIM setup and configuration data through the backplane (refer to Appendix D in the *CVIM Communications Manual*).

Using Message Mail

With OCR-PAK installed, you can use "message mail" to send any of the ASCII commands for the OCR windows (see *ASCII Commands* in this chapter). To do so, you list the ASCII command in the External Data Table Address field of the message block to perform the desired function.

Note: Decimal points ("." or "," *international*) in the match strings, or in OCR results when using match strings, are transmitted as ASCII period (.) or comma (,), respectively. Decimal points ("." or "," *international*) in non-match string OCR window results, are transmitted as ASCII period (.).

The example below shows a typical message block with an ASCII command in the External Data Table Address field:

CONTROL BLOCK 0MSG0:0

F1	Requested Size (element):	0
F2	Priority:	HIGH
F3	Local/Remote:	LOCAL
F4	Local Link Type:	DH +
F5	Remote Link type:	N/A
F6	Station ID:	Node# = 0
F7	Module ID:	Class = CVIM Tw# = 1 Port# = 1
F8	Communication Command:	TYPED READ
F9	Internal Data Table Addr:	0L9:0
F10	External Data Table Addr:	">RR, TS2W,1"

The Set Match String command is a special case, and is described on the next page.

Using Message Mail (continued)

Set Match String – Use this command to set the match string for a string window which is configured for a match operation (**Note:** To use this command, the selected CVIM host must be Pyramid).

Command Format:

">SM, TSnWd" where:
n = *Tool set number.*
d = *Window number.*

To use this command, you must (1) list the ASCII command in the External Data Table Address field, and (2) list the match string in hexadecimally-encoded ASCII, using a null (00) to terminate the string, at the specified Internal Data Table Address.

For example: Suppose window #9 of tool set 1 is a string window set for match string operation. You have listed the match string – 31 32 33 34 35 36 00 (hexadecimally-encoded ASCII for **1 2 3 4 5 6 null**) – at the specified Internal Data Table Address (0L9:0 in the example).

The following control block will set the match string of window #9 to **1 2 3 4 5 6 :**

CONTROL BLOCK 0MSG0:0

F1	Requested Size (element):	0
F2	Priority:	HIGH
F3	Local/Remote:	LOCAL
F4	Local Link Type:	DH +
F5	Remote Link type:	N/A
F6	Station ID:	Node# = 0
F7	Module ID:	Class = CVIM Tw# = 1 Port# = 1
F8	Communication Command:	TYPED READ
F9	Internal Data Table Addr:	0L9:0
F10	External Data Table Addr:	">SM, TS1W9"

Note: If the match string you are setting includes letters, use *upper case letters* only.

Note: If the match string you send is not a valid match string, the CVIM module will not accept the new match string, and will set the Configuration Fault discrete bit.

Configuration Blocks for OCR Windows

The configuration blocks for the CVIM module inspection windows are described in tables in Appendix D of the *CVIM Communications Manual*. Table 7.B updates the window configuration blocks to include the configuration information for OCR windows for both tool sets 1 and 2.

Table 7.B
Configuration Blocks #42-65- Windows 1-24 (Toolset 1)
Configuration Blocks #104-127- Windows 1-24 (Toolset 2)

Remote I/O & RS-232 Word #*	Bit #	Definition	Usage	Notes
0	0-15	Block Transfer Signature		
1	0	Enable	0 = Disabled 1 = Enabled	
1	1-15	Reserved		
2-4	0-15	Reserved		
5	0-7	Window Low Threshold	0 = Low Limit . . . 63 = High Limit	
5	8-15	Window High Threshold	0 = Low Limit . . . 63 = High Limit	You can set this to any value from 0-63 – however, the CVIM module automatically sets this to 63 for OCR windows
6-10	0-15	Reserved		
11	0-15	Window X Location		
12	0-15	Window Y Location		
13	0-15	Window Width		
14	0-15	Window Height		
15	0-15	Search Window X Location		
16	0-15	Search Window Y Location		
17	0-15	Search Window Width		
18	0-15	Search Window Height		
19-27	0-15	Reserved		

* Refer to the *CVIM Communications Manual* for Pyramid Integrator long word descriptions.

Configuration Blocks for OCR Windows
(continued)

Table 7.B (continued)
Configuration Blocks #42-65- Windows 1-24 (Toolset 1)
Configuration Blocks #104-127- Windows 1-24 (Toolset 2)

Remote I/O & RS-232 Word #*	Bit #	Definition	Usage	Notes
28	0-15	Fail Range High (Integer)		Not applicable for OCR windows
29	0-15	Fail Range High (Fraction)		Not applicable for OCR windows
30	0-15	Fail Range Low (Integer)		Not applicable for OCR windows
31	0-15	Fail Range Low (Fraction)		Not applicable for OCR windows
32	0-15	Warning Range High (Integer)		Not applicable for OCR windows
33	0-15	Warning Range High (Fraction)		Not applicable for OCR windows
34	0-15	Warning Range Low (Integer)		Not applicable for OCR windows
35	0-15	Warning Range Low (Fraction)		Not applicable for OCR windows

* Refer to the *CVIM Communications Manual* for Pyramid Integrator long word descriptions.

Results Blocks for OCR Windows

The results blocks for the CVIM module inspection windows are described in the tables in Appendix C of the *CVIM Communications Manual.* Table 7.C and 7.D update the window results blocks to include the result information for OCR windows.

Note: Decimal points ("." or "," *international*) in the match strings or in OCR window results are transmitted as ASCII period (.) or comma (,), respectively.

Note the following with regard to OCR window results:

For string windows, the results value listed for that window represents the number of characters recognized in the string (characters not recognized are not counted).

For example, if window #8, a string window, successfully reads the eight characters **A B C D E F G H**, the result for window #8 would be 00 00 00 08.

For character windows, the results value is a listing of ASCII codes for the characters recognized by that character window. Each character requires 8 bits; the 32-bit result can list from one to four characters. If packing is *disabled*, one character is listed per result; if packing is *enabled*, one to four characters are listed per window result.

For example, suppose window #3, a string window, reads the characters **A B C D E F**, with packing *enabled.* The results for windows #4 and #5 (two character windows) would be the hexadecimally-encoded ASCII characters listed as follows:

Window #4: 41 42 43 44 (characters **A**, **B**, **C**, **D**)
Window #5: 45 46 00 00 (characters **E**, **F**)

Now suppose window #3 reads the characters **A B C D E F**, with packing *disabled.* The results for windows #4-9 (six character windows) would be the hexadecimally-encoded ASCII characters listed as follows:

Window #4: 00 00 00 41 (character **A**)
Window #5: 00 00 00 42 (character **B**)
Window #6: 00 00 00 43 (character **C**)
Window #7: 00 00 00 44 (character **D**)
Window #8: 00 00 00 45 (character **E**)
Window #9: 00 00 00 46 (character **F**)

Results Blocks for OCR Windows *(continued)*

Table 7.C
Numerical Results Data- Results Block 1

Word #			Bit #	Definition	Usage	Notes
Backplane		RS-232 and Remote I/O				
Toolset 1	Toolset 2					
48-49	312-313	24-25	0-15	Window #1 Value		Luminance- 17.16 Object- 32 bit integer Pixel- 32 bit integer Template- 32 bit integer Gradient- 32 bit integer OCR - 32 bit integer
50-51	314-315	26-27	0-15	Window #2 Value		Same as window #1
52-53	316-317	28-29	0-15	Window #3 Value		Same as window #1
54-55	318-319	30-31	0-15	Window #4 Value		Same as window #1
56-57	320-321	32-33	0-15	Window #5 Value		Same as window #1
58-59	322-323	34-35	0-15	Window #6 Value		Same as window #1
60-61	324-325	36-37	0-15	Window #7 Value		Same as window #1
62-63	326-327	38-39	0-15	Window #8 Value		Same as window #1

Results Blocks for OCR Windows *(continued)*

Table 7.D
Numerical Results Data- Results Block 2

Word #			Bit #	Definition	Usage	Notes
Backplane		RS-232 and Remote I/O				
Toolset 1	Toolset 2					
90-91	354-355	2-3	0-15	Window #9 Value		Luminance- 17.16 Object- 32 bit integer Pixel- 32 bit integer Template- 32 bit integer Gradient- 32 bit integer OCR - 32 bit integer
92-93	356-357	4-5	0-15	Window #10 Value		Same as window #9
94-95	358-359	6-7	0-15	Window #11 Value		Same as window #9
96-97	360-361	8-9	0-15	Window #12 Value		Same as window #9
98-99	362-363	10-11	0-15	Window #13 Value		Same as window #9
100-101	364-365	12-13	0-15	Window #14 Value		Same as window #9
102-103	366-367	14-15	0-15	Window #15 Value		Same as window #9
104-105	368-369	16-17	0-15	Window #16 Value		Same as window #9
122-123	286-387	34-35	0-15	Window #17 Value		Same as window #9
124-125	388-389	36-37	0-15	Window #18 Value		Same as window #9
126-127	390-391	38-39	0-15	Window #19 Value		Same as window #9
128-129	392-393	40-41	0-15	Window #20 Value		Same as window #9
130-131	394-395	42-43	0-15	Window #21 Value		Same as window #9
132-133	396-397	44-45	0-15	Window #22 Value		Same as window #9
134-135	398-399	46-47	0-15	Window #23 Value		Same as window #9
136-137	400-401	48-49	0-15	Window #24 Value		Same as window #9

Statistics for OCR Windows

The statistics for the OCR windows are based on the accumulated results for the inspections sampled. For OCR windows, these results are as follows:

- For the string window, the result, or "reading," is the number of characters recognized or matched in the inspected string. This can range from 0 to the maximum number of characters as set in the Max. Chars: box.
- For each character window, the result, or "reading," is always either a "1," if all of the characters in that window are recognized or matched, or a "0," if any of the characters are not recognized or not matched.

The window statistics byte allocations are listed in Appendix C of the *CVIM Communications Manual.* Note this addition to the listing:

- Minimum and Maximum values for Window (OCR) are stored as 32-bit integers.

See *Statistics Display* in Chapter 6 for further descriptions and examples of the OCR window statistics.

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